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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
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VOLUME 20, NUMBER 10
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W87-07595 -- W87-08600

The Secretary of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1988.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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SELECTED WATER RESOURCES ABSTRACTS

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1B. Aqueous Solutions and Suspensions

GEOMETRIC MODELING OF DISSOLUTION KINETICS: APPLICATION TO APATITE,
Northwestern Univ., Evanston, IL. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2K.
W87-08348

2. WATER CYCLE

2A. General

SUMMER AND WINTER RAINFALL INTERCEPTION IN AN OAK FOREST. PREDICTIONS WITH AN ANALYTICAL AND A NUMERICAL SIMULATION MODEL,
Groningen Rijksuniversiteit (Netherlands). Dept. of Physical Geography.
For primary bibliographic entry see Field 2B.
W87-08117

COMPARATIVE HYDROLOGICAL BEHAVIOUR OF FORESTED AND CLEARED CATCHMENTS IN SOUTHEASTERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
G. J. Burch, R. K. Bath, I. D. Moore, and E. M. O'Loughlin.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 19-42, March 1987. 10 fig, 5 tab, 20 ref.

Descriptors: *Rainfall-runoff relationships, *Forest management, *Clearcutting, *Catchment areas, *Hydrology, *Forests, *Australia, Runoff, Grasslands, Soil water, Hydraulic conductivity, Permeability coefficient, Rainfall.

The effects of clearing on the hydrology of small upland catchments were evaluated on two experimental catchments; one vegetated by natural remnant eucalypt forest and the other completely cleared of forest and maintained in grassland for over 80 yrs. The hydraulic properties of soils in both catchments were measured. The grassland catchment generated high-peak stormflows and large discharge volumes irrespective of antecedent soil moisture conditions, whereas the forest catchment gave little runoff provided the antecedent soil water content was below 60% of the available storage capacity. Subsurface (0.1-0.4 m) hydraulic conductivities of the grassland soils were about half those of the undisturbed forest at slope positions above the depression areas, and even less in the depressions, and this produced the differences in runoff behavior of the two catchments. Water table responses to rainfall in the two catchments indicated that continuous macropore pathways for preferential water movement contributed to rapid rises and falls in forest water tables, but these pathways appeared to be absent under grassland. Impermeable depression areas in the grassland catchment generated much of the runoff from the catchment, so that it behaved as if it were constantly in an advanced stage of saturation. In contrast, the depression areas under forest were relatively permeable and therefore runoff was delayed until the soils became wet, provided hydrophobic conditions had not developed. Runoff from a 277 sq km catchment, containing almost equal proportions of forest and grassland and with comparable topography to the two experimental catchments, was analyzed to demonstrate that findings from the two small catchments could be used to interpret the hydrological behavior of the large catchment. The implications of these results for the future management of forested landscapes are discussed. (Author's abstract)
W87-08119

HYDROLOGIC CHARACTERIZATION OF NOSR 1.
TRW, Inc., McLean, VA. Energy and Environmental Div.
For primary bibliographic entry see Field 2E.
W87-08215

INTERPRETATION OF TRACER DISPLACEMENT DURING INFILTRATION OF RIVER WATER TO GROUNDWATER,
Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland).
E. Hoehn, and P. H. Santschi.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 633-640, April 1987. 6 fig, 3 tab, 30 ref.

Descriptors: *Groundwater movement, *Surface-groundwater relations, *Tracers, *Infiltration, *Groundwater recharge, *Tritium, *Aquifers, Rivers, Wells, Transport, Model studies.

The accidental release of a tritium pulse of about 500 Ci into a river in northern Switzerland allowed the measurement of travel times at a site where the river recharges a granular aquifer almost perpendicularly to the groundwater flow. A series of sampling wells had been previously installed in the aquifer. Most wells give access to shallow freshly infiltrated water. The infiltrated water flows along in the top layer of the aquifer, thus allowing for a one-dimensional analysis of the spreading process from the river to the groundwater in the wells. The linear groundwater flow velocities calculated from the tritium responses at distances from the river of up to 500 m confirm the velocities determined from an earlier local-scale uranine experiment at the same site. The scarce data used to describe tracer transport in the aquifer allowed for an assessment of dispersivity with the method of moments. A linearly scale-dependent dispersivity is evaluated from the mode of increase of the temporal variance of the tracer concentration distribution. Some wells revealed bimodal responses; here the method of moments is applied in combination with a two-layer model. (Author's abstract)
W87-08340

STUDY OF CELL MODELS: 1. A MANIFOLD CELL MODEL FOR DISTRIBUTED SURFACE RUNOFF SYSTEMS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08342

STUDY OF CELL MODELS: 2. THE EFFECT OF TIME DELAY ON THE LIMITING FORMS OF CASCADE AND MANIFOLD CELL MODEL RESPONSE FUNCTIONS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08343

STUDY OF CELL MODELS: 3. A PILOT STUDY ON THE CALIBRATION OF MANIFOLD CELL MODELS IN THE TIME DOMAIN AND IN THE LAPLACE DOMAIN,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08344

DERIVATION OF A CATCHMENT AVERAGE UNIT HYDROGRAPH,
Institute of Hydrology, Wallingford (England).
D. B. Boorman, and D. W. Reed.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-164574. Price codes: A04 in paper copy; and A01 in microfiche. Report No. 71, July 1981. 50 p, 27 fig, 8 tab, 12 ref, append.

Descriptors: *Rainfall-runoff relationships, *Runoff, *Model studies, *Hydrography, *Floods, Mathematical models, Hydrology, Surface water, Unit hydrographs.

Two methods of deriving a catchment average unit hydrograph from a number of recorded flood events in rainfall-runoff modelling were considered, (i) averaging unit hydrographs derived from individual events, and (ii) joint analysis of a group of events to determine an average unit hydrograph directly. The problems of instability in least-squares unit hydrographs derived from individual events are found to have little influence on average unit hydrographs determined for eight trial catchments. Event superposition followed by a least-squares solution was favored for computational economy. Other techniques have other merits, but the differences were considered to be insignificant in application. Replacing the least-squares criterion by an iterative solution of the dominant equations was shown to bring derivation of an average unit hydrograph within the scope of hand calculation. (Author's abstract)
W87-08415

SOME RIVER RUNOFF MODELS,
G. V. Zheleznyakov, and A. I. Denisov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 549-551, September 1986. 2 fig, 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 28-29, September 1986.

Descriptors: *Streamflow forecasting, *Rainfall-runoff relationships, *Mathematical models, *Model studies, *Flow discharge, *Flood forecasting, *Conferences, Reviews, Flood flow, Stream discharge, Catchment areas, Streams.

The papers presented on the theme of 'Rainfall-Runoff Models' at the 21st Congress of the International Association for Hydraulic Research held in 1985 in Melbourne, Australia, were reviewed. The paper of W. H. Hager from Switzerland was devoted to an assessment of the possibilities of using a nonlinear rainfall-runoff model for determining peak discharges on drainage basins of an arbitrary rectangular form for small streams. Australian scientists examined problems of flood forecasting with the use of nonlinear rainfall-runoff models, which provide for separating the drainage area into individual stretches or drainage basins of tributaries, including reservoirs. A West German expert examined mathematical models of three types, which can be used in reservoir operating practice for evaluating the character of floods. Another Australian scientist studied the problems of extrapolation of nonlinear rainfall-runoff regression models. A pair of Austrians examined in a general form a two-dimensional statistical method of analyzing the frequency of floods, their volumes and peaks, as well as the possibility of using this method in streamflow regulation. The authors' conclusions and several case studies were given. (Wood-PTT)
W87-08575

2B. Precipitation

SIMPLE METHOD FOR GENERATING DAILY RAINFALL DATA,
California Univ., Davis. Dept. of Agronomy and Range Science.
S. Geng, F. W. T. Penning de Vries, and I. Supit.
Agricultural and Forest Meteorology, Vol. 36, No. 4, p 363-376, April 1986. 8 fig, 5 tab, 20 ref.

Descriptors: *Rainfall forecasting, *Weather data collections, *Simulation analysis, *Rainfall, *Model studies, *Probabilistic process, *Estimating equations, Meteorological data collection, Simulation, Markov process, Distribution, Weather, Mathematical studies, Estimating, Agriculture, Data interpretation.

The availability of weather data limits the applicability of rainfall simulation methods. These model parameters were evaluated over time and at different places, revealing certain general characteristics. It is found that the transitional probability of a wet day followed by a wet day tends to be greater but parallel to the transitional probability of a dry day followed by a wet day; this leads to a linear relationship of the transitional probabilities to the fraction of wet days per month. Moreover, the beta parameter in a gamma distribution function, which is used to describe the amount of rainfall, is

closely related to the amount of rain per wet day owing to the positive skewness of the rainfall distribution. Based on these relationships, a simple method is introduced, by which model parameters can be estimated from monthly summaries instead of from daily values. The suggested method provides a convenient vehicle for applying weather simulation models to areas in which its use had been impossible because of the unavailability of long series of daily weather data. (Author's abstract)
W87-07608

USE OF PRECIPITATION DATA TO IDENTIFY SOIL MOISTURE PATTERNS AND THE GROWING SEASONS IN EASTERN KENYA,
National Range Research Station, Makindu (Kenya).
D. K. Musembi, and J. F. Griffiths.
Agricultural and Forest Meteorology, Vol. 37, No. 1, p 47-61, May 1986. 9 fig, 7 tab, 6 ref.

Descriptors: *Growing season, *Weather data collections, *Soil water, *Distribution patterns, *Kenya, *Precipitation, *Estimating equations, Data interpretation, Weather, Rainfall, Soil properties, Mathematical studies, Estimating, Regression analysis, Prediction, Water requirements, Agriculture, Planning.

Eight stations with 36 years of rainfall record were selected in the dry region of Kenya, east of 37 deg E longitude to study the nature of the moisture patterns during the Short and the Long rains (October through June). Findings of relevance to agriculture are: (1) the distributions of the start, end, and duration of the growing seasons are not significantly skewed or significantly different from the normal distribution; (2) the start and end times of the Short rains season show a southward trend; (3) the Short rains growing season is found to last longer, be more reliable, and have a higher soil moisture content than the Long rains season for stations located south of the equator; and (4) the opposite is true for stations north of the equator. (Author's abstract)
W87-07609

DETERMINATION OF THE SPEED OF MOVING RAINFALL PATTERNS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
M. H. Diskin.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 1-14, March 1987. 7 fig, 2 tab, 7 ref.

Descriptors: *Rainfall patterns, *Rainfall distribution, *Hyetographs, *Weather patterns, *Mathematical equations, Rainfall, Velocity, Equations, Spatial distribution, Meteorology, Climatology.

The speed and direction of movement of rainfall patterns can be derived from data sets comprised of the coordinates (x,y) of a number of rainfall recording stations and the times of arrival (T) of some prominent feature of the recorded hyetographs. The problem may be interpreted geometrically as the determination of the equation of an inclined plane in the x,y,t space, so that it best represents the set of data points. The speed of movement is given by the inverse of the maximum slope of the plane and its direction is parallel to that of the maximum slope. The proposed method is based on minimizing the sum of the squared deviations between the observed arrival times (T) and values (t) computed by the equation of the inclined plane. (Author's abstract)
W87-07611

USE OF RAINFALL FORECASTS IN THE OPTIMAL MANAGEMENT OF SMALL-HOLDER RICE IRRIGATION - A CASE STUDY,
Birmingham Univ. (England). Dept. of Civil Engineering.
M. J. Hamlin, and D. H. Rees.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 15-29, March 1987. 6 fig, 7 tab, 37 ref.

Descriptors: *Rainfall forecasting, *Irrigation scheduling, *Irrigation efficiency, *Model studies, Catchment areas, Runoff, Performance evaluation, Irrigation, Rainfall, Climatology, Meteorology.

Efficient irrigation scheduling requires information on future reservoir inflows and field irrigation requirements. Where rainfall plays a significant part in determining these variables it is important to be able to forecast that rainfall accurately. Two rainfall modelling techniques are assessed on their ability to reproduce the necessary historic rainfall statistics and, when routed through a deterministic catchment model, to produce the correct runoff characteristics. For the data studied, a Markov chain - gamma distribution model is the more promising but there is an evident need for improvements in the technique. (Author's abstract)
W87-07612

DEVELOPMENT AND EVALUATION OF CLOUD WATER COLLECTIONS,
Nevada Univ. System, Reno. Atmospheric Sciences Center.
For primary bibliographic entry see Field 7B.
W87-07653

STANDARD PROJECT STORM PRECIPITATION AND SNOWMELT TEMPERATURE CRITERIA FOR THE 9,570-SQUARE MILE CLEARWATER RIVER DRAINAGE ABOVE SPAULDING, IDAHO,
National Weather Service, Silver Spring, MD. Office of Hydrology.
F. K. Schwarz.
NOAA Technical Memorandum NWS HYDRO 42, September 1986. 146 p, 124 fig, 9 tab, 24 ref.

Descriptors: *Runoff forecasting, *Precipitation, *Meteorological data collection, *Snowmelt, *Storm runoff, *Clearwater River, Air temperature, Streamflow, Weather data collections, Maps, Rainfall-runoff relationships, Catchment areas, Isohyets, Weather patterns, Spatial distribution, Seasonal variation.

Standard project storm (SPS) precipitation and snowmelt temperature criteria are developed in this report for the total 9,570 sq mi drainage of the Clearwater River above Spaulding, Idaho. Temperature criteria for snowmelt are developed for the November through June period with emphasis on SPS-level criteria for the 3-day SPS period and for three antecedent days. Basin precipitation experience is reviewed and the procedures for selecting the storm sample for statistical analysis is described. The direct method based on basin average precipitation is discussed for determining limits for the SPS precipitation magnitude. The meteorology of cool-season storms in the Pacific northwest is discussed with particular reference to the major storms over the Clearwater River basin. The meteorological features of major storms that have occurred during the May-June snowmelt period are presented. Various indirect procedures that are used to determine the magnitude of the SPS are described. Final results of both direct and indirect measurements are presented along with geographical distribution of the average rainfall amounts, depth-duration characteristics, seasonal variation, and the development of snowmelt criteria for November through June. Applications of both the SPS precipitation values and the snowmelt temperature criteria are discussed. (Geiger-PTT)
W87-07726

ANNUAL REPORT, 1984.
Interagency Task Force on Acid Precipitation, Washington, DC.
Annual Report to the President and Congress, 1984. 102 p, 22 fig, 1 tab.

Descriptors: *Acid rain, *Water pollution sources, *Path of pollutants, *Monitoring, *Air pollution effects, *Water pollution effects, Nitrogen, Alkalinity, Sulfur, Model studies, Environmental tracers, Networks, Air pollution, Ecological effects, Environmental effects, Water pollution prevention, Lakes.

Highlights of the National Acid Precipitation Assessment Program for 1984 are presented. A method for detecting total reactive atmospheric nitrogen species was developed. The first national estimates of natural alkaline emissions were made. The reliability of measurements of natural sulfur emissions was improved. Several emissions data bases were completed for man-made sources of sulfur dioxide and its temporal patterns of change in lakes and forests. The meteorological components of the Regional Acid Deposition Model were developed and tested. Data from the Cross Appalachian Tracer Experiment were made available. Results of nitrate and sulfate deposition across the Philadelphia urban area were presented. Other atmospheric processes of nitrates and sulfur dioxide were reported. A pilot deposition monitoring network was established. Forty-four new stations were established in the National Trends Network (NTN). Quality assurance tests of the field measurements and of the chemical analysis of NTN samples were conducted. Topics studied under the aquatic effects of acid rain included: northeastern lakes, water chemistry, and distribution of aquatic biota in sensitive areas. Topics studied under the terrestrial effects of acid rain included: effects on crops, softwood trees of the Piedmont region of southern states, and the sulfate concentration of streams of the Coweeta watershed. Several advances were made in studying the effects of acid rain on materials and cultural resources. Technologies for the control of acid deposition effects are reported. Integrated assessments methodologies which will trace changes in emissions through atmospheric transport, transformation, and deposition to changes in effects are being developed. International and program management activities are presented along with a discussion of the role of science in making decisions regarding acid deposition. (Geiger-PTT)
W87-07728

THUNDERSTORMS: AN IMPORTANT MECHANISM IN THE TRANSPORT OF AIR POLLUTANTS,
Maryland Univ., College Park. Dept. of Meteorology.
For primary bibliographic entry see Field 5B.
W87-07810

CHEMISTRY OF FOGWATER AND ESTIMATED RATES OF OCCULT DEPOSITION IN AN AGRICULTURAL AREA OF CENTRAL SWITZERLAND,
Bern Univ. (Switzerland). Inst. of Plant Physiology
J. Fuhrer.
Agriculture, Ecosystems and Environment, Vol. 17, No. 3/4, p 153-164, September 1986. 2 fig, 4 tab, 27 ref. Federal Office for Education and Science COST 61a bis.

Descriptors: *Fog, *Acid rain, *Agricultural areas, *Path of pollutants, *Occult deposition, Air pollution, Fallout, Hydrogen ion concentration, Hydrochloric acid, Ammonium compounds, Sulfur compounds, Switzerland.

From an ecological point of view, studies of the chemical composition of fogwater and clouds are important because impaction of droplets can be an important transfer process for water and various inorganic and organic substances from the atmosphere to the biosphere. This process can be described as occult precipitation. This study attempts to determine fogwater components and estimate fluxes for selected elements via fogwater deposition in an agricultural area in central Switzerland. As a result of the accumulation of cold air from mountain regions in prealpine basins, radiation fogs occur frequently from autumn to early spring, especially during night-time. Fog occurs in the area south of Bern on 60-70% of all days, while other parts of the Swiss central plateau experience fog on more than 90% of all days. Fogwater samples were collected at Bern-Belpmoos, 515 m above sea level, at the bottom of a wide valley located in an agricultural area. Samples were collected from October to March of 1983-84 and 1984-85 either with active or static collectors, and analyzed for major inorganic ions, pH and electrical conductivity. Ionic concentrations in fogwater were very high in comparison with those found in wet-only samples

(mean enrichment factor was about 50). NH4(+) was the dominant cation, SO4(2-) the dominant anion. Median pH was 5.60. Samples with pH less than 5 contained HCl as a major strong acid. The data from active collection agreed with those from passive collection, although no direct comparison was possible. Based on an average bulk deposition velocity for fogwater droplets, rates of occult deposition for water and selected ions were calculated and compared with rates of wet and dry (particle) deposition. Occult deposition accounted for only 5-6% of total deposition, or 8-15% of total wet deposition of S, N and Cl(-) during the period of frequent fog occurrence (autumn-early spring). Thus, on an annual basis, occult deposition contributes little to total atmospheric deposition of pollutants, and therefore, an ecological risk from fog occurrence in this agricultural area is limited to only short periods of time. (McFarlane-PTT)
W87-07822

CONTINUOUS-FLOW REAL-TIME AND FLOW INJECTION DETERMINATION OF RAINWATER PH WITH A POLY(VINYL CHLORIDE)-BASED TUBULAR MEMBRANE ELECTRODE,
University of Central Florida, Orlando. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W87-07824

ANALYSIS OF SPATIAL INHOMOGENEITIES IN CUMULUS CLOUDS USING HIGH SPATIAL RESOLUTION LANDSAT DATA,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 7B.
W87-07930

CONTRIBUTION OF MESOSCALE CONVECTIVE WEATHER SYSTEMS TO THE WARM-SEASON PRECIPITATION IN THE UNITED STATES,
Pennsylvania State Univ., University Park. Dept. of Meteorology.
J. M. Fritsch, R. J. Kane, and C. R. Chelius.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 10, p 1333-1345, October 1986. 10 fig, 3 tab, 40 ref. NSF Grant ATM-8218208, NOAA Cooperative agreement NA82AA-H-00027.

Descriptors: *Convective precipitation, *Seasonal variation, *Weather patterns, *Precipitation, *Distribution, *Weather forecasting, Forecasting, Drought, Hydrology, Convection, Temporal distribution, Spatial distribution, Storms, Hurricanes, Crop production.

The contribution of precipitation from mesoscale convective weather systems to the warm-season (April-September) rainfall in the United States is evaluated. These systems were found to account for approximately 30% to 70% of the warm-season precipitation over much of the region between the Rocky Mountains and the Mississippi River, especially from June through August. Series of convective weather systems are very likely the most prolific precipitation producer in the United States, rivaling and even exceeding that of hurricanes. Changes in the large-scale circulation patterns affected the seasonal precipitation from mesoscale convective weather systems by altering the precipitation characteristics of individual systems. For the drought period of 1983, the frequency of the convective systems remained nearly the same as in the 'normal' year of 1982; however, the average precipitation area and the average volumetric production decreased significantly. Nevertheless, the rainfall produced by mesoscale convective weather systems in the drought year accounted for most of the precipitation received during the critical crop growth period. It is concluded that mesoscale convective weather systems may be a crucial precipitation-producing deterrent to drought and an important mechanism for enhancing midsummer crop growth throughout the midwestern United States. Significant improvements in prediction of such systems would probably benefit quantitative precipitation forecasts and hydrologic forecasts of runoff. (Author's abstract)
W87-07931

LOGNORMAL FIT TO RAINDROP SPECTRA FROM FRONTAL CONVECTIVE CLOUDS IN ISRAEL,
Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
G. Feingold, and Z. Levin.
Journal of Climate and Applied Meteorology JJCAMEJ, Vol. 25, No. 10, p 1346-1363, October 1986. 12 fig, 5 tab, 33 ref, 2 append.

Descriptors: *Convective precipitation, *Clouds, *Distribution, *Rain, *Israel, *Weather, *Mathematical analysis, Precipitation, Standard deviation, Rainfall rate, Mathematical studies, Probabilistic process, Temporal distribution.

Measurements of raindrop size spectra in Israel were carried out over two years. It was determined that the size distribution can best be described by a lognormal distribution. With its parameters weighted by a certain choice of moments, this distribution has a better squared-error fit to the observed data than the gamma or the exponential distributions. Furthermore, this distribution is well suited for explaining drop size distribution effects in the dual-parameter remote measurement of rainfall. The lognormal distribution has the advantage that all its moments are also lognormally distributed. Its parameters have physical meaning (drop concentration, the geometric mean diameter, and standard geometric deviation), facilitating direct interpretation of variations in the drop size spectrum. The different moments can easily be integrated to obtain simple expressions for the various rainfall parameters. At high rainfall rates (> 45 mm/h), the distribution tends to a steady state form. These results suggest that the lognormal representation is suitable for a broad range of applications and can facilitate interpretation of the physical processes which control the shaping of the distribution. (Author's abstract)
W87-07932

SPATIAL COHERENCE OF AFRICAN RAINFALL ANOMALIES: INTERHEMISPHERIC TELECONNECTIONS,
Clark Univ., Worcester, MA. Dept. of Geography.
S. E. Nicholson.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 10, p 1365-1381, October 1986. 14 fig, 3 tab, 73 ref. NSF Grants ATM8019009 and ATM8212781.

Descriptors: *Spatial distribution, *Africa, *Rainfall, *Weather patterns, *Meteorological data collection, *Climatology, Weather, Distribution, Data collections, Tropical regions, Climates, Subtropic zone, Mathematical studies, Temporal distribution, Standard deviation.

The spatial patterns of rainfall variability over the African continent are examined using a regionally averaged data set comprising the records of 1,087 stations. Typical rainfall departure patterns, or anomaly types, are derived using a linear correlation method to assess the similarity of annual departure maps for the years 1901 to 1973. For the region north of the equator, most years fall into one of six types, four of which show a strong opposition between equatorial and subtropical latitudes and two of which show departures of the same sign over the whole region. For the continent as a whole, six types are also derived. These reflect the patterns derived using northern Africa alone, with conditions in the southern subtropics resembling those in subtropical latitudes north of the equator. Continentally, two principal spatial patterns of rainfall variation are evident: anomalies of the same sign over most of Africa and anomalies of the opposite sign in equatorial and subtropical latitudes. Strong interhemispheric teleconnections in rainfall are therefore apparent. The results are discussed in the framework of common continental factors in rainfall variability and in regional climate dynamics. (Author's abstract)
W87-07933

DELAYED EFFECTS OF CLOUD SEEDING WITH SILVER IODIDE,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Atmospheric Research.
For primary bibliographic entry see Field 3B.
W87-07934

RAINFALL OVER OCEANS INFERRED FROM NIMBUS 7 SMMR: APPLICATION TO 1982-83 EL NINO,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
C. Prabhakara, D. A. Short, W. Wiscombe, R. S. Fraser, and B. E. Vollmer.
Journal of Climate and Meteorology JCAMEJ, Vol. 25, No. 10, p 1464-1474, October 1986. 7 fig, 2 tab, 28 ref.

Descriptors: *Rainfall, *Marine climates, *Satellite technology, *Weather patterns, *Meteorological data collection, *Remote sensing, Climates, Precipitation, Radiation, Microwaves, Climatology, Clouds, Atmospheric water, Data collections, Seasonal variation.

Nimbus 7 Scanning Multichannel Microwave Radiometer (SMMR) measurements at five frequencies in the region 6.6 to 37 GHz were analyzed to infer precipitation over the global oceans. The data show that the combined liquid water in the clouds and rain increases the brightness temperature almost linearly with frequency in the 6.6 to 18 GHz region. Further, as the atmospheric water vapor absorption and the effects of scattering by precipitation particles are relatively weak at 6.6 and 10.7 GHz, a technique to remotely sense the liquid water content in the atmosphere was developed based on the brightness measurements at these two frequencies. Seasonal mean patterns of liquid water content in the atmosphere derived from SMMR over global oceans relate closely to climatological patterns of precipitation. Based on this, an empirical relationship was derived to estimate precipitation over the global oceans on a seasonal basis from satellite measurements made during the years 1979-81. The deviations from these three-year means produced by the 1982-83 El Nino were then deduced from the SMMR measurements. It was noted that precipitation over the ITCZ in the north, the South Pacific Convergence Zone, and the oceans around Indonesia is drastically reduced, while a substantial increase in precipitation was observed over the normally dry central and eastern equatorial Pacific Ocean. (Author's abstract)
W87-07935

REMOTE SENSING OF HAIL WITH A DUAL LINEAR POLARIZATION RADAR,
Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 7B.
W87-07936

ACETYLENE REDUCTION RATE AS A PHYSIOLOGICAL INDICATOR OF THE RESPONSE OF FIELD-GROWN SOYBEANS TO SIMULATED ACID RAIN AND AMBIENT GASEOUS POLLUTANTS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W87-07980

DROUGHT STRATEGIES IN EAST AFRICA: THE CLIMATOLOGIST'S ROLE,
University of East Anglia, Norwich (England). Climatic Research Unit.
J. P. Palutikof.
Climatic Change CLCHDX, Vol. 9, No. 1/2, p 67-78, August-October 1986. 36 ref.

Descriptors: *Drought, *East Africa, *Climatology, *Agriculture, *Prediction, *Planning, *Hydrologic budget, *Famine, Distribution, Spatial distribution, Crop production, Crop yield, Regression analysis, Mathematical studies, Forecasting, Weather forecasting, Rainfall, Evapotranspiration, Grain crops.

The structure of the pathway from drought to harvest failure to famine is examined, and strategies for lessening or averting impact are discussed. Intervention is possible at the link between drought and harvest failure, based on knowledge of the climatology of drought-prone regions. Strategies include short-term predictions, long-term predictions, and the analysis of spatial patterns of drought. Methods of climate-based short-term (within growing-season) forecasting of crop yield include: (1) use of a water balance model to estimate soil moisture deficits; (2) applying regression analysis techniques to develop models of crop-climate relationships; and (3) long-range weather forecasts. Long-term predictions rely on the fact that drought is a function of the balance between rainfall and evapotranspiration; it is possible to develop scenarios for future trends in these variables, arising from both physical and anthropogenic forcing. Finally, analysis of spatial patterns of drought at the national level will permit deeper insight into the phenomenon. This has potential benefits for planning, including identification of drought-prone areas and of spatial compensation zones (regions that are drought-free while grain-producing areas are affected). These three items together form a comprehensive strategy for applied research into the factors underlying drought. (Author's abstract)
W87-07995

DROUGHT PREDICTION,
Ibadan Univ. (Nigeria). Dept. of Geography.
J. S. Oguntoyinbo.
Climatic Change CLCHDX, Vol. 9, No. 1/2, p 79-90, August-October 1986. 4 fig. 27 ref.

Descriptors: *Drought, *Forecasting, *Model studies, *Remote sensing, *Telemetry, *Reviews, *Weather forecasting, Numerical analysis, Mathematical studies, Mathematical models, Rainfall, Climatology, Weather, Prediction, Statistical analysis, Distribution, Temporal distribution, Spatial distribution, Precipitation, Albedo, Radiation.

The achievements and problems of the various techniques of drought prediction are reviewed. Directions in which progress is possible in the prediction of future climate include the prediction of periodicities of climate phenomena, the use of numerical general circulation models (GCMs), and the identification of time-lagged teleconnections. The use of periodicities has been criticized for a lack of physical theory to explain the suggested link between drought and, for example, sunspots. The principle of time-lagged teleconnections is that changes induced in any one area of the world are likely to produce other changes elsewhere, on a world-wide basis. Examples are given; however, few such connections have predictive value because they are overridden by other effects. GCMs portray the three-dimensional circulation of a hemisphere or of the globe; over long periods, they produce a set of global statistics of temperature, pressure, wind, and precipitation that resemble those of the present-day climate. Numerical GCMs appear to offer some hope for drought prediction. The use of computers facilitates simulation of varying climatic conditions by varying the relative importance of various model parameters (e.g., the variation of surface albedo or soil moisture). It is concluded that a thoroughly reliable technique for drought prediction does not yet exist. (Author's abstract)
W87-07996

WEATHER MODIFICATION IN ARID REGIONS: THE ISRAELI EXPERIENCE,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
For primary bibliographic entry see Field 3B.
W87-07997

ANALYSIS OF RAINFALL IN THE SOUTH-WEST REGION OF SAUDI ARABIA,
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Civil Engineering.
M. A. Nouh.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 83, Part 2, p 339-349, March 1987. 6 fig, 4 tab, 7 ref. KAST Operating grants AR-02-17 and AR-05-62.

Descriptors: *Rainfall, *Weather data collections, *Regional analysis, *Saudi Arabia, *Meteorology, *Climatology, Distribution, Storms, Estimating, Design standards.

Thirty rainfall station records were used to identify the regional rainfall distribution in the south-west of Saudi Arabia. The data are rainfall depths in durations varying from 10 min to 12 h. The period of the records varies from 8 to 18 years. To have larger sets of data, the records were grouped according to the magnitudes of the one-hour annual maximum rainfall depths of a 5 year return period. Using the grouped records, quartile analysis was employed to derive regional growth curves and to identify the seasonal distribution of rainfall and storm profiles throughout the region. In addition, areal reduction factor curves were derived to enable the estimation of a mean areal rainfall event from a point rainfall event. The regional results have been recommended for use in engineering design. (Author's abstract)
W87-08081

CONTRIBUTION OF RAINWATER TO VARIABILITY IN SURFACE OCEAN HYDROGEN PEROXIDE,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
W. J. Cooper, E. S. Saltzman, and R. G. Zika.
Journal of Geophysical Research (C) JGRCEY, Vol. 92, No. 3, p 2970-2980, March 1987. 9 fig, 1 tab, 26 ref. ONR Grant N00014-80-C-0042.

Descriptors: *Water chemistry, *Atmospheric deposition, *Spatial variability, *Rainfall, *Hydrogen peroxide, Gulf of Mexico, Atlantic Ocean, Florida Keys, Storms, Oceans, Stratified layers.

Hydrogen peroxide concentrations have been determined in marine rain from the Gulf of Mexico (114-820 times 10 to the minus 7th power mol/L, x = 402 times 10 to the minus 7th power mol/L, s = 218 times 10 to the minus 7th power mol/L), the western Atlantic Ocean (84-206 times 10 to the minus 7th power mol/L, x = 127 times 10 to the minus 7th power mol/L, s = 45 times 10 to the minus 7th power mol/L), and one rain event off the Florida Keys (x = 284 times 10 to the minus 7th power mol/L). In several cases, simultaneous measurements of the concentration of H2O2 in the surface ocean were also determined. These measurements were made with the ship under way using a continuous flow sampling system with the intake at the bow. In shallow stratified layers, rain events can increase the existing hydrogen peroxide concentration by a factor greater than 10 and dramatically increase the mean H2O2 concentration of mixed depth layers of 50 m or more. Rain is a significant transient source of H2O2 in the surface ocean. (Author's abstract)
W87-08093

RAINFALL CHARACTERISTICS OF THE PRESCOTT, ARIZONA, STORM OF 23-24 SEPTEMBER 1983,
Bureau of Reclamation, Denver, CO. Div. of Planning Technical Services.
V. H. Leverson.
Monthly Weather Review MRWEAB, Vol. 114, No. 12, p 2344-2351, December 1986. 3 fig, 4 tab, 13 ref.

Descriptors: *Rainfall, *Prescott, *Rainfall intensity, *Meteorology, Weather data collections, Storms, Arizona, Precipitation.

On 23-24 September 1983 the vicinity of Prescott, Arizona, experienced a 36 h period of recurrent heavy rains. Measurements obtained from a supplemental precipitation survey of the storm-affected area are used to derive maximum 6 h and total storm (36 h) precipitation patterns. Rainfall depth-area-duration (DAD) data computed from the patterns are compared with three standards of precipitation severity: (1) documented extreme rainstorms in the southwestern United States, (2) precipitation-frequency values and (3) probable maximum precipitation (PMP) estimates. The comparisons show the Prescott storm to be an exceptional event that produced rainfall exceeding 100-yr amounts as well as some categories of PMP. (Author's abstract)
W87-08094

NORTH AMERICAN PRECIPITATION AND TEMPERATURE PATTERNS ASSOCIATED WITH THE EL NINO/SOUTHERN OSCILLATION (ENSO),
National Oceanic and Atmospheric Administration, Washington, DC. Climate Analysis Center.
C. F. Ropelewski, and M. S. Halpert.
Monthly Weather Review MRWEAB, Vol. 114, No. 12, p 2352-2362, December 1986. 11 fig, 1 tab, 24 ref.

Descriptors: *Climatology, *El Nino/Southern Oscillation, *Rainfall patterns, *North America, *Weather data collections, *Regional analysis, Vector maps, Harmonics, Precipitation, Temperature.

An investigation of the 'typical' North American precipitation and temperature patterns associated with the El Nino/Southern Oscillation (ENSO) is described. Monthly surface temperature and precipitation data are analyzed using a method designed to identify regions of the globe that have responses associated with ENSO. Monthly composites, covering idealized two-year ENSO episodes, are computed for temperature and precipitation at all stations with data spanning seven or more ENSO events. The first harmonic is extracted from the 24 monthly composite values and plotted in the form of a two-year harmonic dial vector. When plotted on a map of North America, these vectors reveal both the regions of coherent response and the phase of the response with respect to the evolution of the ENSO episode. Time series of temperature and precipitation for the regions identified in the harmonic vector maps are examined to determine the magnitudes of the responses and the percentage of the time that the identified response actually occurred in association with the ENSO events. The temperature anomalies are expressed in terms of standardized departures, while precipitation departures are expressed as percentiles of the appropriate gamma distributions, fitted to the entire data record. The analysis shows that above normal precipitation was associated with ENSO in 18 out of 22 cases (81%) in the 'season' starting with October of the ENSO year to March of the following year for an area of North America that includes parts of the southeastern United States and northern Mexico. Above normal precipitation was also observed in the Great Basin area of the western United States in 9 out of 11 cases (81%) for the April through October 'season' during ENSO years. No high latitude precipitation signals were indicated by this analysis. Areas of Alaska and western Canada experienced positive temperature anomalies in 17 out of 21 ENSO episodes (81%) during the 'season' defined by December of the ENSO year through the following March. Parts of the southeastern United States near the Gulf of Mexico were found to have negative temperature anomalies associated with 20 out of 25 ENSO episodes (80%) for the 'season' October of the ENSO year through the following March. (Author's abstract)
W87-08095

INITIATION OF CONVECTIVE STORMS AT RADAR-OBSERVED BOUNDARY-LAYER CONVERGENCE LINES,
National Center for Atmospheric Research, Boulder, CO.
J. W. Wilson, and W. E. Schreiber.
Monthly Weather Review MRWEAB, Vol. 114, No. 12, p 2516-2536, December 1986. 14 fig, 4 tab, 43 ref.

Descriptors: *Meteorology, *Doppler radar, *Convective storms, *Rocky Mountains, *Boundary layers, *Convergence lines, Storms, Weather patterns, Thunderstorms, Remote sensing, Clouds, Convection.

The origin of 653 convective storms occurring over a 5000 sq km area immediately east of the

Colorado Rocky Mountains from 18 May to 15 August 1984 was examined. Seventy-nine percent of the 418 storms that initiated within the study area occurred in close proximity to radar-observed boundary-layer convergence lines. This percentage increased to 95% when only the more intense storms (> or = dBZ sub e) were considered. Colliding convergence lines initiated new storms or intensified existing storms in 71% of the cases. A new storm took a median time of 24 min to grow to 30 dBZ following line collision. The convergence lines ranged in length between ten and several hundred kilometers. Both radar and mesonet stations indicated that the primary convergence was concentrated in a zone 0.5 to 5 km in width. These lines were characterized on Doppler radar as thin lines of enhanced reflectivity between 0 and 20 dBZ sub e and as a line of strong radial or azimuthal gradient in Doppler velocity. These lines were observed even in clear air in the absence of any clouds. The origin of many of the convergence lines was unknown and requires further study. The most common identified origin was from convective storm outflows. Other origins were believed to be topography and differential heating. This study, which utilized radar data, supports the findings of Purdom, who utilized satellite data, which indicated that mesoscale boundary-layer convergence lines play a major role in determining where and when storms will form. These results suggest that what often appears as random thunderstorm formation (air mass thunderstorms) is usually deterministic. Major advances now appear possible in the 0.2 h time-specific forecasts of thunderstorms. Realization of this potential will require the integration of Doppler radar to detect and monitor convergence lines, high resolution satellite data to monitor cloud growth, and surface and sounding data to estimate atmospheric susceptibility to deep convection. (Author's abstract)
W87-08096

STRUCTURE AND DECAY OF A RAINBAND IN HURRICANE IRENE (1981),
National Center for Atmospheric Research, Boulder, CO.
G. M. Barnes, and G. J, Stossmeister.
Monthly Weather Review MRWEAB, Vol. 114, No. 12, p 2590-2601, December 1986. 15 fig, 1 tab, 32 ref. NOAA Order NA24CC-G-01004.

Descriptors: *Rainbands, *Hurricane, *Hurricane Irene, *Storms, Thermodynamics, Kinetics, Reflectivity, Clouds, Convection, Winds, Flow, Hydrometeors, Evaporation.

The mesocale thermodynamic, kinemstic and reflectivity structure of a rainband observed in Hurricane Irene on 27 September 1981 is presented. Data are from 16 aircraft passes, from 150 to 4700 m MSL through the rainband which was located SSW of the circulation center of the northward moving hurricane. Cross sections of the rainband as a function of height and radial distance from the storm center reveal the following: (1) little or no decrease of theta sub e in the subcloud layer associated with the weak convective cells in the rainband; (2) large differences in static stability between the north and south sides of the band; (3) a change of the radial wind component in the subcloud layer, from flow toward the circulation center to flow away from it as the rainband weakens. The decay of the rainband is believed to be related to mesoscale subsidence and the location of the rainband relative to the motion of the hurricane. Melting and evaporation of hydrometeors falling between the eyewall and the rainband are the most plausible causes of the subsidence. The collapse of the rainband is considered to be an example of the negative feedback possible among mesoscale features in the hurricane. (Author's abstract)
W87-08097

RELATIONSHIP BETWEEN LARGE-SCALE CONVECTIVE RAINFALL AND COLD CLOUD OVER THE WESTERN HEMISPHERE DURING 1982-84,
National Oceanic and Atmospheric Administration, Washington, DC. Climate Analysis Center.
P. A. Arkin, and B. N. Meisner.
Monthly Weather Review MRWEAB, Vol. 115, No. 1, p 51-74, January 1987. 17 fig, 1 tab, 39 ref.

Descriptors: *Weather data collections, *Convective rainfall, *Rainfall, *Cold clouds, *Remote sensing, *Satellite technology, *Clouds, Precipitation, Temperature, Distribution, Estimating.

Estimates of areal- and time-averaged convective precipitation derived from geostationary satellite imagery using a simple thresholding technique are presented. The estimates are based on measurements of the monthly mean fraction of 2.5 deg X 2.5 deg areas covered by clouds whose equivalent blackbody temperature in infrared imagery is below 235 K. The transformation between fractional coverage and rainfall amount is based upon comparisons of fractional coverages using a variety of temperature thresholds and spatial and temporal averaging scales with areal averaged rainfall from the GARP Atlantic Tropical Experiment. Three-year means of the estimated precipitation for the period December 1981-November 1984 are shown for each of the (3-month) calendar seasons and compared with published descriptions of the long-term seasonal mean rainfall fields. Over the tropical oceans agreement is quite good with no evidence of any systematic errors. Over the Americas, long-term means derived from station observations of rainfall show less extensive areas of heavy rainfall than those derived here, and a slight tendency for lower peak values during the rainy season. The interannual variability during the 3-yr period is described and compared with station observations of rainfall. The relationship between cloud cover and rainfall in the tropics (30 deg N-30 deg S) is found to be similar to that found in previous studies, with a threshold of 235 K giving highest correlations, while observations between 30 deg and 50 deg were best correlated with a threshold of 220 K. The large changes in rainfall distribution over South America associated with the 1982-83 ENSO episode and the breaking of the drought in Northeast Brazil during 1984 are clear in the estimates presented here, but the amplitude of the changes is somewhat overestimated. Warm season rainfall observed over the United States is less than the estimates, except near the Gulf of Mexico and southeast United States coast where the degree of overestimation increases away from the coast. (Author's abstract)
W87-08098

CHANGES IN THE LOW-LEVEL KINEMATIC AND THERMODYNAMIC STRUCTURE OF HURRICANE ALICIA (1983) AT LANDFALL,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
M. D. Powell.
Monthly Weather Review MRWEAB, Vol. 115, No. 1, p 75-99, January 1987. 11 fig, 2 tab, 44 ref, append.

Descriptors: *Hurricane Alicia, *Kinematics, *Storms, *Winds, *Hurricanes, *Landfall, *Hurricanes, Flow, Rainbands, Temperature, Dew point, Advection, Thermodynamics, Boundary layers.

Aircraft, land station, and buoy data were composited with respect to the center of Hurricane Alicia (1983) for three 8-h periods corresponding to prelandfall in the open Gulf of Mexico, landfall in the Galveston area, and postlandfall in the vicinity of Houston. Comparison of the wind analyses before, during, and after landfall emphasizes the land-sea frictional asymmetry at landfall. In addition, other asymmetries in the surface wind field and differences between the flight-level and the surface wind fields are revealed. The asymmetric structure of the surface wind field may be interpreted as having resulted from the combined effects of land-sea roughness differences, background environmental flow, and storm translation. The land-sea frictional difference acted to oppose the mean vortex flow over land and producing surface inflow on the left side and outflow on the right side, while the effect of the storm translation increased winds on the right and decreased winds on the left. At landfall, the analysis revealed a broad region of high wind speeds and a mesoscale divergence-convergence couplet along the outer rainband axis just offshore on the northeast (right) side of the storm. The outer rainband axis acted as an obstruction to the surface flow, separating the warmer central core of the storm from the environment through which the storm moved. In contrast to recent numerical model studies, surface convergence was also noted on the left side of the storm just offshore, despite outflow at flight level. Analyses of temperature, dewpoint, and equivalent potential temperature indicate that loss of the oceanic heat and moisture source, combined with advection of drier air on the landward side of the storm, was responsible for cooling and drying of the inflowing boundary layer air. Upon introduction of this air into the core convection and vertical ascent, a decrease in the release of latent heat could then lead to cooling in the middle levels of the storm and a subsequent increase in the central sea-level pressure. (Author's abstract)
W87-08099

REAL-DATA NUMERICAL STUDY OF THE DEVELOPMENT OF PRECIPITATION ALONG THE EDGE OF AN ELEVATED MIXED LAYER,
Pennsylvania State Univ., University Park. Dept. of Meteorology.
M. N. Lakhtakia, and T. T. Warner.
Monthly Weather Review MRWEAB, Vol. 115, No. 1, p 156-168, January 1987. 19 fig, 17 ref. USAF Grant AFOSR-83-0064.

Descriptors: *Storms, *Model studies, *Numerical analysis, *Simulation, *Rainfall, *Precipitation, *Weather patterns, *Weather data collections, Convection, Mixed layers, Clouds, Underrunning.

An 18-h numerical simulation of the weather associated with the severe-storm outbreak in the region of the Texas-Oklahoma panhandles, during the AVE-SESAME IV study period (9-10 May 1979), was performed using the Pennsylvania State University/National Center for Atmospheric Research (PSU/NCAR) mesoscale model. This simulation and the related sensitivity tests provided the four-dimensional data sets that were used to reach a better understanding of the processes that were involved in this case in the development of severe convection along the edge of the elevated mixed layer (EML). The sensitivity studies were performed to isolate the contributions of differential surface forcing, latent heating and the low-level moisture gradient to the development of the underrunning, its intensification, and the heavy rainfall. These studies showed that the differential surface heating at the edge of the EML is the most important single factor responsible for initiating the underrunning, and therefore the precipitation, during this case. Compared to the precipitation amounts produced by the complete model during the 9-h period of heavy precipitation (2100-0600 GMT), only 3% was produced after the elimination of the surface differential heating associated with the cloud-cover and soil moisture-availability gradients. The elimination of the latent-heating feedback in the model atmosphere caused a decrease in the 18-h precipitation amounts of 50%. Finally, the strong gradient in the low-level mixing ratio alone the edge of the EML had a surprisingly important direct dynamic influence on the underrunning, and consequently on the precipitation. (Author's abstract)
W87-08100

ROLE OF CONVECTIVE PARAMETERIZATION IN THE SIMULATION OF A GULF COAST PRECIPITATION SYSTEM,
Universities Space Research Association, Huntsville, AL.
M. W. Kalb.
Monthly Weather Review MRWEAB, Vol. 115, No. 1, p 214-234, January 1987. 21 fig, 37 ref. NASA Contract NAS8-34767.

Descriptors: *Convective storms, *Convection, *Parameterization, *Model studies, *Simulation, *Weather patterns, *Gulf Coast, *Precipitation, *Rainfall, *LAMPS model, Clouds, Thermodynamics, Kinematics.

Three 15 h LAMPS (Limited Area Mesoscale Prediction System) model simulations were per-

formed on a 70 km grid to examine the role of convective parameterization on the modeling of the evolution of the Gulf Coast precipitation system of 6-7 March 1982. The first simulation neglected moist processes. The second used an explicit representation for moist physics as suggested by Orlanski and Ross (1984) and Rosenthal (1978; 1979). A third simulation employed the LAMPS sequential plume cumulus cloud model as convective parameterization for the mesoscale model. Results from these experiments indicate that the manner in which moist thermodynamics is included in a meso-alpha scale model has significant bearing on model depiction and evolution of mesoscale structures. The dry simulation developed and maintained a low pressure area consistent with the observed Gulf Coast precipitation system; however, kinematic and thermodynamic fields were substantially modified by the inclusion of moist physics. The simulation with parameterized convection outperformed that with grid-resolved moist physics in several important respects. While precipitation in the grid-resolved simulation formed in the same location as the parameterized convection and as observed, it was slower to develop and was initiated about 2 h late over the Gulf Coast. During the latter half of that simulation, the Gulf Coast system underwent explosive development giving midtropospheric diabatic heating rates and vertical motions that were unrealistically large near the center of the main precipitation system. A superadiabatic layer was generated near the top of the model precipitation system for this experiment in response to the extreme midlevel heating. Overdevelopment appeared to be a result of a runaway CISK-like feedback between low-level moisture convergence, upward vertical motion and latent heat release. These difficulties reflected the inability of grid-resolved convective circulation. The convective parameterization effectively acted as a convective adjustment to preclude development of the superadiabatic layer that led to overdevelopment in the explicit simulation. (Alexander-PTT)
W87-08101

DETERMINING RAINFALL INTENSITY AND TYPE FROM GOES IMAGERY IN THE MID-LATITUDES,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
For primary bibliographic entry see Field 7B.
W87-08103

EFFECT OF AMBIENT OZONE POLLUTION AND ACIDIC RAIN ON THE GROWTH AND CHLOROPHYLL CONTENT OF GREEN AND WHITE ASH,
New Jersey Agricultural Experiment Station, New Brunswick.
For primary bibliographic entry see Field 5C.
W87-08111

EFFECT OF FERTILIZER ON THE GROWTH OF RADISH PLANTS EXPOSED TO SIMULATED ACIDIC RAIN CONTAINING DIFFERENT SULFATE TO NITRATE RATIOS,
Boyce Thompson Inst. for Plant Research, Ithaca, NY.
For primary bibliographic entry see Field 5C.
W87-08112

SUMMER AND WINTER RAINFALL INTERCEPTION IN AN OAK FOREST. PREDICTIONS WITH AN ANALYTICAL AND A NUMERICAL SIMULATION MODEL,
Groningen Rijksuniversiteit (Netherlands). Dept. of Physical Geography.
A. J. Dolman.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 1-9, March 1987. 1 fig, 3 tab, 16 ref.

Descriptors: *Throughfall, *Rainfall-runoff relationships, *Model studies, *Comparison studies, *Rainfall interception, *Oak forests, *Analytical models, *Simulation models, *Numerical analysis, Simulation, Rainfall, Prediction, Seasonal variation, Throughfall, Canopy.

A comparison is made of the predictions of an analytical and a numerical simulation model of rainfall interception in an oak forest in The Netherlands. The models were applied to predict interception in both summer and winter conditions. The agreement with observed throughfall is good for both models in both seasons. It is argued that annual variation in canopy structure may influence rainfall interception in summer. (Author's abstract)
W87-08117

STRUCTURE OF A TYPHOON RAINBAND OBSERVED BY TWO DOPPLER RADARS,
Meteorological Research Inst., Yatabe (Japan).
M. Ishihara, Z. Yanagisawa, H. Sakakibara, K. Matsuura, and J. Aoyagi.
Journal of the Meteorological Society of Japan JMSJAU, Vol. 64, No. 6, p 923-939, December 1986. 16 fig, 37 ref.

Descriptors: *Radar, *Typhoons, *Rainbands, *Doppler radar, *Winds, Precipitation, Rainfall, Updrafts, Evaporation, Storms, Air flow, Model studies, Gravity waves, Clouds.

Two ground-based Doppler radars were used to examine the wind fields and the internal structure of the rainband of Typhoon 8305. The rainband is located 300 km to the northeast of the storm center and is embedded in a broad stratiform precipitation region. The air flow around the rainband is nearly two-dimensional along the rainband. Composite cross-sections in the radial direction from the storm center reveal the secondary circulation associated with the rainband. A convergence zone with a large outward tilt exists from the inner edge of the rainband at lower levels to the outer edge at middle levels. Frictional inflow air at lower levels rises at the inner edge of the rainband and a mesoscale updraft of 2 m/s forms. A mesoscale downdraft less than 1 m/s exists in the maximum reflectivity zone outside the updraft zone. The downdraft is thought to be produced by the drag forces and evaporation of raindrops. The convergence between the relatively cold air associated with the downdraft and the low-level warm inflow relative to the storm center produces the updraft. This cloud dynamic mechanism is thought to play the main role in maintaining the rainband. Taking into account the band-relative air flow, the air with large theta sub e value near the cloud base approaches from the outer region of the typhoon toward the storm center, and enters the rainband through the inner edge due to its large crossing angle of 25 deg. The warm air reaches the convergence zone and rises without passing through the intense rainfall area at the center of the rainband. Detailed analysis of air flow shows that convective-scale updrafts exist in the rainband at an interval of about 5 km despite the relatively uniform reflectively pattern. A relative vorticity within this circulation exceeds .003/s. The internal structure of the rainband was compared with other observations and numerical modeling results. The propagation speed of the rainband and the surface pressure change associated with the passage of the rainband do not suggest a relationship between internal gravity waves and the rainband. (Author's abstract)
W87-08129

ACID RAIN AND TRANSPORTED AIR POLLUTANTS: IMPLICATIONS FOR PUBLIC POLICY.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 5B.
W87-08208

EFFECTS OF ACID RAIN ON PLANT MICROBIAL ASSOCIATIONS IN CALIFORNIA,
California Univ., Berkeley. Dept. of Plant and Soil Biology.
For primary bibliographic entry see Field 5C.
W87-08217

PROJECT SKYWATER 1985-86 CRADP DATA INVENTORY: COLORADO RIVER AUGMENTATION DEMONSTRATION PROJECT.
Water and Power Resources Service, Denver, CO. Office of Atmospheric Resources Management.
Bureau of Reclamation Division of Atmospheric Resources Research, July 1986. 46 p, 12 tab.

Descriptors: *Colorado River, *Weather data collections, *Project Skywater, *Precipitation, *Cloud seeding, *Weather modification, Orographic precipitation, Radar, Remote sensing.

Contained in this report is an inventory of all data collected from November 1985, through March 1986 in association with the CRADP (Colorado River Augmentation Demonstration Project), a weather modification research project in winter orographic cloud seeding. It is subdivided into an introduction plus 10 sections: (1) radiometer, (2) aircraft, (3) PROBE, (4) satellite, (5) precipitation gauges, (6) photographs, (7) 2D images, (8) tethersonde. (9) acoustic sounder, (10) seeding events. Most of the sections are subdivided into two main components: (1) a general description of equipment, modes of operation, and types of data available for analyses (both visual products and computer files) and (2) tables of data inventories which list start and stop times, locations, and other pertinent information related to data sampling. (Author's abstract)
W87-08235

ISOTOPIC COMPOSITION OF PRECIPITATION IN TROPICAL STATIONS,
International Atomic Energy Agency, Vienna (Austria).
R. Gonfiantini.
Acta Amazonica, Vol. 15, No. 1/2, p 121-139, March-June 1985. 7 fig, 3 tab, 8 ref.

Descriptors: *Weather data collection, *Precipitation, *Oxygen isotopes, *Evapotranspiration, Isotopic tracers, Seasonal variation, Tropic zone, Deuterium, Statistical analysis.

Recently the IAEA published the statistical treatment of isotopic data of precipitation of the stations of the IAEA/WMO global network. On the basis of these results and of other results available in the IAEA files, I shall try in this paper to review briefly some characteristics of the stable isotope composition of precipitation in tropical stations. The stations from which the data will be discussed are shown in fig. 1. A table lists the stations along with geographical coordinates, altitude, mean temperature and mean annual precipitation. (Author's abstract)
W87-08275

CANOPY STRUCTURE AND CLOUD WATER DEPOSITION IN SUBALPINE CONIFEROUS FORESTS,
New York Botanical Garden, Bronx, NY. Inst. of Ecosystem Studies.
G. M. Lovett, and W. A. Reiners.
Tellus TELLAL, Vol. 38B, No. 5, p 319-327, November 1986. 5 fig, 1 tab, 35 ref. NSF Grant DEB 79-07346; Electric Power Research Inst. RP 1907-1 and RP 2621.

Descriptors: *Path of pollutants, *Acid rain, *Precipitation, *Canopy, *Canopy structure, *Cloud water, *Subalpine forests, *Coniferous forests, *Deposition, *Model studies, Evaporation, Velocity, Clouds.

The relationship between canopy structure and cloud water deposition is explored using a modeing approach applied to subalpine conifer forests in the northeastern US. The zero plane displacement height was found to decrease monotonically with stand thinning, while the roughness length showed a unimodal pattern, peaking at a value of total surface area index (SAI) of about 5. The cloud water deposition velocity also was unimodal, increasing from 28 to 34 cm/s as the simulated stand was thinned from SAI = 13 to SAI = 6, and then decreasing with further thinning. The calculated resistance to cloud water deposition was greater than the resistance to momentum transfer except at very low values of SAI. Evaporation rate also showed a unimodal pattern as a function of SAI, but the pattern was less pronounced than that of

cloud water deposition. These results suggest that agents which moderately reduce the SAI of closed forest stands may increase the deposition of cloud water. If some aspect of cloud water deposition causes canopy deterioration in subalpine forest, a positive feedback could occur between the canopy thinning and the cloud water deposition. A calculation of potential deposition on the lee side of gaps in the forest indicates a maximum possible deposition velocity approaching 200 cm/s, illustrating the expected heterogeneity of deposition rates across the subalpine landscape. (Author's abstract)
W87-08301

CLOUD DROPLET NUCLEATION AND CLOUD SCAVENGING OF AEROSOL SULPHATE IN POLLUTED ATMOSPHERES,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 5B.
W87-08302

OBSERVATIONS ON ACIDITY AND IONS IN EAST GREENLAND PRECIPITATION,
Miljoestyrelsen, Roskilde (Denmark). Luftforureningslaboratoriet.
For primary bibliographic entry see Field 5B.
W87-08303

TOWARDS THE PREDICTION OF SAHELIAN RAINFALL FROM SEA SURFACE TEMPERATURES IN THE GULF OF GUINEA,
Laval Univ., Quebec. Dept. de Genie Chimique.
A. Bah.
Tellus TELLAL, Vol. 39A, No. 1, p 39-48, January 1987. 5 fig, 5 tab, 34 ref.

Descriptors: *Rainfall, *Weather forecasting, *Gulf of Guinea, *Sahel, *Meteorology, *Temperature effects, Oceans, Seasonal variation, Prediction, Upwelling.

The possible link between sea surface temperature (SST) in specific areas of the Gulf of Guinea and summer Sahelian rainfall is investigated for the purpose of forecasting Sahelian rainfall. Analyses of data series of rainfall in the Sahel and SST in the Eastern Tropical Atlantic reveal that summer Sahelian rainfall is dependent on SST distribution, according to the period (dry or wet) and/or the specific oceanic area (coastal, equatorial or intermediate zone) under consideration. The occurrence of warm surface waters in the Gulf of Guinea is coincident with reduction of summer rainfall in the Sahel, mainly during dry periods. The same relationship does not hold during wet periods. It is suggested that summer Sahelian rainfall could be predicted: (a) from SST in the intermediate warm waters area and the equatorial upwelling zone 1-2 months earlier; (b) from previous quarterly rainfall data in the Sahel. (Author's abstract)
W87-08305

INTRA-SEASONAL VARIABILITY OF RAINFALL AND ATMOSPHERIC ENERGETICS OVER NORTHEAST BRAZIL DURING THE RAINY SEASON OF 1979,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
D. N. Sikdar, and J. B. Elsner.
Tellus TELLAL, Vol. 39A, No. 1, p 49-60, January 1987. 12 fig, 4 tab, 11 ref. NASA Grant NAG 5-384.

Descriptors: *Meteorology, *Seasonal variation, *Rainfall patterns, *Atmosphere, *Brazil, Winds, Thermodynamics, Energy, Rainfall, Air currents.

As an extension to recent studies concerning interannual and seasonal variability of rainfall over northeast Brazil, this study looks at the atmosphere immediately over northeast Brazil on a daily basis. Intra-seasonal variability of rainfall, winds and thermodynamic energies are examined for the wet season (February through May) of 1979. A trend is observed in the temporal rainfall pattern, from short duration showers in the early season to longer and more vigorous systems in the later season. May is noted as a transitional month between the wet and dry seasons. Circulation changes associated with rainy days include an upper-level trough extending further northward, weakened low-level easterlies and an increased moist energy flux from the north. These findings agree well with earlier investigations. (Author's abstract)
W87-08306

SATELLITE OBSERVATIONS OF HURRICANE ELENA (1985) USING THE VAS 6.7-(MU)M 'WATER-VAPOR' CHANNEL,
Wisconsin Univ.-Madison. Space Science and Engineering Center.
For primary bibliographic entry see Field 7B.
W87-08313

ROLE OF RESEARCH MEASUREMENT NETWORKS AS CONTRIBUTORS TO FEDERAL ASSESSMENTS OF ACID DEPOSITION,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 7A.
W87-08314

EXAMPLE OF HURRICANE TRACKING AND FORECASTING WITH A GLOBAL ANALYSIS-FORECASTING SYSTEM,
European Centre for Medium Range Weather Forecasts, Reading (England).
For primary bibliographic entry see Field 7B.
W87-08315

EVALUATION OF UNCERTAINTY ASSOCIATED WITH ALUMINUM EQUILIBRIUM CALCULATIONS,
Syracuse Univ., NY. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-08328

FITTING JOHNSON S SUB B CURVE BY THE METHOD OF MAXIMUM LIKELIHOOD TO ANNUAL MAXIMUM DAILY RAINFALLS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08350

POLLUTION ACROSS BORDERS: ACID RAIN - ACID DIPLOMACY.
New Hampshire Univ., Durham. Dept. of Forest Resources.
For primary bibliographic entry see Field 5B.
W87-08497

INTERNATIONAL ASPECTS OF ACID RAIN: WHERE DO WE STAND,
Institute of European Environmental Policy, Bonn (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W87-08498

NORDIC PERSPECTIVE OF ACID RAIN: NORWAY,
Miljoeverndepartementet, Oslo (Norway).
For primary bibliographic entry see Field 5B.
W87-08499

NORDIC PERSPECTIVE OF ACID RAIN: SWEDEN,
Royal Ministry for Foreign Affairs, Stockholm (Sweden).
For primary bibliographic entry see Field 5B.
W87-08500

EUROPEAN NATIONAL RESPONSES TO THE EXPANDING PROBLEM OF ACID RAIN,
Pioneer Foundation, Inverness, CA.
For primary bibliographic entry see Field 5B.
W87-08501

CANADIAN DIPLOMATIC PERSPECTIVE OF ACID RAIN,
Consul General of Canada in New England, Boston, MA.
For primary bibliographic entry see Field 5B.
W87-08502

U.S. EPA PERSPECTIVE OF ACID RAIN,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5B.
W87-08503

US DIPLOMATIC PERSPECTIVE OF ACID RAIN,
Department of State, Washington, DC. Office of Canadian Affairs.
For primary bibliographic entry see Field 5B.
W87-08504

ENVIRONMENT CANADA PERSPECTIVE OF ACID RAIN,
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W87-08505

GOVERNOR'S PERSPECTIVE ON ACID RAIN,
National Governor's Association, Washington, DC. Acid Rain Task Force.
For primary bibliographic entry see Field 5B.
W87-08506

VERMONT PERSPECTIVE ON ACID RAIN,
Vermont State Agency of Environmental Conservation, Montpelier.
For primary bibliographic entry see Field 5B.
W87-08507

ONTARIO PERSPECTIVE ON ACID RAIN,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5B.
W87-08508

CONGRESSMAN'S PERSPECTIVE ON ACID RAIN,
For primary bibliographic entry see Field 5B.
W87-08509

LOGNORMALITY OF RAIN RATE,
Maryland Univ., College Park. Dept. of Mathematics.
B. Kedem, and L. S. Chiu.
Proceedings of the National Academy of Sciences USA, Vol. 84, No. 4, p 901-905, February 1987. 4 fig, 2 tab, 15 ref. Office of Naval Research Grant N00014-86-K0007 and NASA Grant NAS-29271.

Descriptors: *Model studies, *Rainfall rate, *Mathematical studies, Mathematical analysis, Regression analysis, Stochastic process, Rainstorms.

A stochastic regression model is used in modeling rain rate. Under some conditions on the model parameters, it is shown that rain rate is asymptotically lognormal. An application of the model to the GATE (global atmospheric research program, Atlantic tropical experiment) data shows a remarkable agreement between the assumed and estimated model parameters for rain rate averaged over sufficiently large area and a sampling interval of 15 minutes. (Author's abstract)
W87-08538

FUNCTIONAL BOX-COUNTING AND MULTIPLE ELLIPTICAL DIMENSIONS IN RAIN,
Meteorologie Nationale, Paris (France).
S. Lovejoy, D. Schertzer, and A. A. Tsonis.
Science SCIEAS, Vol. 235, No. 4792, p 1036-1038, February 1987. 4 fig, 22 ref.

Descriptors: *Data interpretation, *Mathematical models, *Clouds, *Rainfall, Stratification, Scaling, Algorithms, Mathematical analysis.

Many physical systems that have interacting structures that span wide ranges in size involve substan-

tial scale invariant (or scaling) subranges. In these regimes, the large and small scales are related by an operation that involves only the scale ratio. The system has no intrinsic characteristic size. In the atmosphere gravity causes differential stratification, so that the scale change involves new elliptical dimensions (d sub el). Fields that are extremely variable, such as rain, involve multiple scaling and dimensions that characterize the increasingly intense regions. Elliptical dimensional sampling and functional box-counting have been used to analyze radar rain data to obtain both the multiple dimensions of the rain field and the estimate d sub el = 2.22 +/- 0.07. (Author's abstract)
W87-08539

2C. Snow, Ice, and Frost

TECHNIQUES FOR PREDICTION OF RUNOFF FROM GLACIERIZED AREAS.
International Association of Hydrological Sciences.
IAHS Publication No. 149, 1985. Internationl Association of the Hydrological Sciences, 2000 Florida Avenue, NW, Washington, DC. Edited by Gordon J. Young. 149 p.

Descriptors: *Glaciers, *Runoff forecasting, *Hydrologic data collections, *Model studies, *Case studies, Runoff, Prediction, Literature reviews, Water supply, Snowmelt, Meteorological data collection, Snowpack, Ablation, Glaciohydrology, Hydrographs, Flood forecasting, Mathematical models.

Predictive techniques used to forecast glacial runoff are presented along with their applications and limitations. Physical factors affecting glaciohydrology include mountain systems, climate (localized and global), and weather systems. Human factors affecting prediction programs and data analysis include water ownership, and the political, economic and social background of the area. Seven models for predicting glacial runoff are discussed and compared. Case studies are presented wherein the models are used to predict water supply in Switzerland, Canada, Greenland, the USSR, China, and Pakistan, and to forecast catastrophic floods in the USSR, Nepal, Pakistan, and Canada. An appendix to the book lists international symposia on high mountain hydrology that took place in the period of 1969-1984. (See also W87-07709 thru W87-07720) (Geiger-PTT)
W87-07708

OVERVIEW,
Inland Waters Directorate, Ottawa (Ontario).
G. J. Young.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 3-23, 2 fig, 1 ref.

Descriptors: *Glaciers, *Runoff forecasting, *Water supply, *Flood forecasting, *Flood control, Hydrologic data collections, Runoff, Prediction, Social aspects, Climate, Weather data collections, Meteorological data collection, Economic aspects, Political aspects.

Glacier runoff forecasting is important to predict water supply and flooding. Diversity in climate and physical features of mountain ranges causes different hydrologic responses making prediction of runoff difficult. The spatial and temporal variability in energy supply has a fundamental effect on the hydrological response of high mountain areas. There are major distinctions, both in total quantities of precipitation and in seasonal distribution, of precipitation between major mountain regions of the world. Regional variabilty in runoff is linked to altitude and mountain geometry. Many hydrological prediction techniques cannot be used in high mountain areas. Formulation and implementation of methods for the prediction of runoff from glacierized areas must take into consideration human factors such as the ownership of water, availability of data bases, and the political, economic and social background of the area. (See also W87-07708) (Geiger-PTT)
W87-07709

OVERVIEW OF CONTEMPORARY TECHNIQUES,
Geological Survey, Tacoma, WA.
A. G. Fountain, and W. Tangborn.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 27-41, 2 fig, 2 tab, 25 ref.

Descriptors: *Runoff forecasting, *Glaciers, *Hydrologic models, *Mathematical models, *Glaciohydrology, *Model studies, Prediction, Snowmelt, Ablation, Snow accumulation, Meteorological data collection, Streamflow, Cumulative runoff, Comparison studies, Runoff rates, Precipitation.

Seven models currently used for predicting glacier runoff are briefly described and compared. The models vary greatly in complexity and scope. The simplest models use a linear relationship between the melt rate of snow or ice and air temperature; the meltwater contributes immediately to runoff. The more sophisticated models have detailed energy balances and internal flow routing through the glacier. Each model can be divided into two sections: calculation of meltwater production and drainage from the glacier. The most accurate part of each model is the melt rate estimation, and the most poorly understood concept is internal glacier drainage. The seven models presented, which represent most of the recent attempts to calculate water drainage through glaciers, are: a snow accumulation and ablation model developed by Anderson (1973), an hourly or daily runoff model for the Vernagtferner Glacier, Oetztal Alps, Austria by Baker et al. (1982), a daily runoff model for Peyto Glacier, Canada and Nordbo Glacier, Southern Greenland by L. Gottlieb (1980), an hourly or daily runoff model for the Aletschgletscher Glacier, Switzerland by H. Land (1980), a model for summer runoff prediction of the Nigardsbreen Glacier, Norway by D. Lundquist (1982), a runoff model (based on the UBC Watershed model) for the Peyto Glacier, Canada by J. Power and G. Young (1979), and a daily runoff model by W. V. Tangborn (1983) applied to three glacier areas of British Columbia, Canada. (See also W87-07708) (Geiger-PTT)
W87-07710

SWITZERLAND CASE STUDY: WATER SUPPLY,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Geophysik.
H. Lang, and G. Dayer.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 45-57, 6 fig, 5 ref.

Descriptors: *Model studies, *Glaciers, *Runoff forecasting, *Hydrologic models, *Switzerland, *Meteorological data collection, Water supply, Weather data collections, Glaciohydrology, Hydroelectric power, Albedo, Radiation, Alblation, Snowpack, Snowmelt, Prediction, Drainage systems, Networks.

Short time forecasts of glacier runoff are important in the optimization of the hydroelectric power generation of the Grande Dixence S.A., Sion, Switzerland. A forecasting model was developed for daily and hourly runoff predictions based on the catchment basin of the Z'mutt Glacier with the gauging station, Stafel. Melt rates are estimated from meteorological observations of solar incoming radiation, air temperature, vapor pressure and precipitation. Indirect ways of taking account of the albedo as a variable are incorporated into the model. The whole ablation season is subdivided and handled in intervals to address the problem of variations in the areal albedo and drainage conditions. To obtain an insight into the statistical structure of the relations between runoff and the meteorological variables, the correlation functions were analyzed for the ablation seasons of the four years, 1967-1970. Air temperature and vapor pressure showed the best correlations with runoff, while the autocorrelation function of discharge, in general, provided direct information on the average drainage conditions. The model provides excellent results for the first 12 hours following the time of issue and gives optimum control of the complex system of conduits operated by the hydropower system. Future improvements for the model include development of meteorological forecasting for the medium time-scale range, recalibration of regression coefficients based on new data, inclusion of a vapor pressure variable, and extension of the observation networks. (See also W87-07708) (Geiger-PTT)
W87-07711

CANADA CASE STUDY: WATER SUPPLY,
National Hydrology Research Inst., Ottawa (Ontario).
J. M. Power.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 59-71, 5 fig, 1 tab, 11 ref.

Descriptors: *Model studies, *Glaciers, *Hydrologic models, *Canada, *Runoff forecasting, *Water supply, Climate, Meteorological data collection, Glaciohydrology, Snowmelt, Preidiction, Streamflow, Hydroelectric power, Economic aspects, Regression analysis, Mathematical studies, Hydrologic data collections.

Glacier runoff is important to the economy of the Columbia River basin for hydroelectric power production and agricultural use. Accurate runoff forecasting could lead to more efficient use of the water resources of the basin. The physiography of the basin and its effects on glacial runoff are described. In the Canadian Columbia River basin, hydrologic forecasting for optimization of power production is carried out on daily and seasonal time scales. Under the provisions of the Columbia River Treaty, the United States pays money to Canada for flood control and power production. Several studies document the economic benefits that could be gained from accurate prediction of glacier runoff in relation to short-term and long-term climatic regimes. The conceptual models dealing with daily predictions of runoff are discussed. These include the Streamflow Synthesis and Reservoir Regulation model (SSARR), the FLOCAST model, and the UBC watershed model. Seasonal time scale forecasts have been made with the VOLCAST model which uses a set of regression programs, the conceptual UBC watershed model, and continuous simulation with the SSARR model. A study of the impact of different future climate scenarios on the glacier runoff regime would give a better understanding of the economic impact of any long-term climatic change. (See also W87-07708) (Geiger-PTT)
W87-07712

GREENLAND CASE STUDY: WATER SUPPLY,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
L. Gottlieb, and R. J. Braithwaite.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 73-80, 1 fig, 26 ref.

Descriptors: *Model studies, *Glaciers, *Runoff forecasting, *Greenland, Meteorological data collection, *Water supply, *Hydrologic models, Streamflow, Hydroelectric power, Sediment transport, Glaciohydrology, Prediction, Weather data collections, Ablation, Hydrologic data collections.

Methods of predicting runoff from glacierized areas in West Greenland are important for developing hydropower projects. All the projects under serious consideration involve storage of summer runoff in multi-year reservoirs formed by damming natural lakes for year-round electricity generation using moderate to high hydraulic heads. Since many of the proposed hydropower projects would use a high proportion of glacial waters, problems of sediment load, such as filling up of reservoirs and wear on hydraulic equipment, must be considered. Data currently being collected include meteorological observations, streamflow observations, glacier inventory, glacier fluctuations, sediment transport and glacier floods. This data can be used in conjunction with site-specific models to generate long-term runoff simulations for project design. Several regional models used to calculate glacial runoff in West Greenland are described. The NAM-II model, a site-specific model developed for

application to arctic areas, extends existing short-term runoff series in Greenland by the use of long-term climatic variables to provide a basis for design of hydropower projects. The NAM-II facilitates the division of basins into sub-areas making it possible to take into account the areal variability of meteorological conditions within the basin. Limitations in modelling procedures are related to the lack of basic data from insufficient measuring sites, instrumentation, and data analysis. (See also W87-07708) (Geiger-PTT)
W87-07713

USSR CASE STUDIES: WATER SUPPLY,
Akademiya Nauk SSSR, Moscow.
A. N. Krenke, and V. M. Kotlyakov.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 81-99, 9 fig, 10 ref.

Descriptors: *Model studies, *Glaciers, *Runoff forecasting, *Hydrologic models, *Water supply, *Soviet Union, Case studies, Glaciohydrology, Mathematical models, Air temperature, Snowmelt, Precipitation, Hydrographs, Radiation, Ablation, Hydrologic data collections, Prediction, Meteorological data collection.

Four models for computing glacial runoff in the USSR are presented. The first model, developed by Drenke (1973, 1982), computes long-term averages of annual values of runoff in glacier systems from air temperature at the height of the equilibrium line. The second model, developed by Abalyan, Mukhin, and Polunin (1980), computes glacial runoff hydrographs in a large river. A computation model for glacial runoff hydrographs developed by Borovikova, Denisov, Trofimova, and Shentsis (1972) is the third model described. A fourth model, developed by Konovalov (1979), incorporates special features of glacier-generated runoff referring to water input (concentration of snow and cooling of the air). A modification of the glacial runoff transformation method is described along with the possibilities of predicting runoff from glacierized areas. (See also W87-07708) (Geiger-PTT)
W87-07714

CHINA CASE STUDY: WATER SUPPLY,
Academia Sinica, Lanzhou (China). Lanzhou Inst. of Glaciology and Cryopedology.
Y. Zhenniang, and L. Zuming.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 101-107, 6 fig, 4 ref.

Descriptors: *Model studies, *Glaciers, *China, *Runoff forecasting, *Hydrologic models, *Water supply, Meteorological data collection, Hydrologic data collections, Snowmelt, Precipitation, Flood forecasting, Streamflow, Prediction, Correlation analysis, Mathematical models, Rainfall-runoff relationships.

The forecasting of glacial runoff in China is important in agriculture, flood control, reservoir water adjustment and other fields. Floods in the mountains of Western China can be classified into three main types according to the major source of water supply: rainfall-on-meltwater, meltwater, and outburst glacier floods. Correlation analysis based upon regression relationships between various hydrological elements, or between hydrological and meteorological elements, is most commonly used for flood forecasting in the mountains of Northwest China. Analyses undertaken on the northern slopes of the Tienshan Mountains indicate close relationships between precipitation and the meteorological elements of the antecedent atmospheric circulation. In forecasting for rainfall-on-meltwater floods, the cumulative dew point temperature of an approaching atmospheric circulation system is calculated at a selected index station some distance upwind of the forecasting area to represent the element of precipitation. In an analogous way, the cumulative antecedent value of rising temperature is taken to represent the amount of meltwater from ice and snow. In forecasting for meltwater floods, which mainly occur in the streams of the Western Kunlun, Pamir and Tienshan mountains, cumulative antecedent temperature can be directly used to predict floods. Glacier outburst floods are very difficult to predict at present; they occur in varying degrees in the Kunlun, Karakoram and Tienshan mountains. For streams in Northwest China which have steep river beds and concentrated short flow times, aerological meteorology approaches are employed in flood forecasting. However, these methods do not account for the effects of basin characteristics on the formation of runoff and do not provide a stable forecasting period. (See also W87-07708) (Geiger-PTT)
W87-07715

PAKISTAN CASE STUDY: WATER SUPPLY,
Pakistan Water and Power Development Authority, Lahore.
For primary bibliographic entry see Field 7B.
W87-07716

USSR CASE STUDY: CATASTROPHIC FLOODS,
Akademiya Nauk SSSR, Moscow.
A. N. Krenke, and V. M. Kotlyakov.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 115- 124, 6 fig, 4 ref.

Descriptors: *Model studies, *Runoff forecasting, *Glaciers, *Flood forecasting, *Mathematical models, *Soviet Union, Hydrologic models, Reservoirs, Flood hydrographs, Streamflow, Discharge hydrographs, Glacier surges, Case studies, Chezy equation, Mannings equation, Channel flow, Glacial lakes.

Models for two types of catastrophic flood outbursts are presented: those from glacier-dammed lakes and those from englacial cavities. The moment of the outburst in glacier-dammed lakes is predicted from the water-balance at the moment when lake volume reaches its maximum. In the USSR, several methods have been proposed to compute the outburst hydrograph and its maximum discharge. The computation method by Glazyrin and Sokolov (1976) is based on widening the channel and the equation of motion. An equation is provided for widening of the channel walls due to heat content of water and energy losses caused by resistance of the walls. A modification of this model developed by Vinogradov (1977) is based on widening the channel and outflow from a short tube. Forecasting outbursts from englacial water reservoirs is complicated by the impossibilty of observing water accumulation. In this case the method of water balance is applied and sudden deviation of the glacial river discharge from the known correlation graphs with neighboring glacial rivers are observed. Vinogradov (1977) proposed a model of the outburst hydrograph for an englacial water reservoir which was used to predict outburst floods on the Tuyuksu Glacier. When the surge was repeated in autumn and winter 1969, the probability of such an outburst was taken into account for the next summer. Computations of its possible volume and hydrograph at different reaches of the river were undertaken by Krenke and Rototaev (1972). Due to the development of a drainage network, a large outburst did not occur. The form of hydrographs was calculated on the basis of tunnel modification with the maximum discharge at the end, and by outburst hydrographs with the maximum discharge at the first moment and its successive fall. Estimations of the runoff transformation in the river valley were made on the basis of the simultaneous solution of the water balance equation of the river reach and dependence values along this reach. (See also W87-07708) (Geiger-PTT)
W87-07717

NEPAL CASE STUDY: CATASTROPHIC FLOODS,
Nagoya Univ. (Japan). Water Research Inst.
H. Fushimi, K. Ikegami, K. Higuchi, and K. Shankar.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 125-130, 6 fig, 5 ref.

Descriptors: *Flood forecasting, *Glaciers, *Glacial lakes, *Runoff forecasting, *Nepal, Glacier surges, Glaciohydrology, Moraines, Mapping, Flood damage, Flash floods, Flood profiles, Topographic mapping, Snowmelt, Ablation, Aerial photography, Satellite technology.

On September 3, 1977, an outburst flood from a moraine-dammed lake occurred in the Mingbo Valley, Dudh Kosi region, East Nepal and the flood wave was recorded at the Rabuwa Hydrological Station 70 km downstream. Houses and property were destroyed, fatalities occurred, and several small bridges were taken out. A topographical map of newly formed terraces shows where the outburst occurred. By using a hand transit, the former moraine-dammed lake was mapped and the volume of water in the lake was estimated to be 400,000 cu m, which is consistent with the calculated volume of the flood wave recorded at Rabuwa. The collapse of the ice-cored moraine had no relationship with marked rainfall around September 3. It is possible that melting of the ice-cored moraine was a reason for the collapse which initiated the outburst flood. It will be necessary to monitor expansion of the glacier lakes by taking aerial photographs and landsat imagery of the glacierized area to predict glacier-outburst floods in the Great Himalayas in the future. (See also W87-07708) (Geiger-PTT)
W87-07718

PAKISTAN CASE STUDY: CATASTROPHIC FLOODS,
Wilfrid Laurier Univ., Waterloo (Ontario). Dept. of Geography.
K. Hewitt.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 131-135, 1 fig, 2 tab, 5 ref.

Descriptors: *Glaciers, *Flood forecasting, *Runoff forecasting, *Dam failure, *Pakistan, Glacier surges, Glacial lakes, Sediment erosion, Satellite technology, Networks, Flash floods, Flood damage, Sediment transport, Flood hydrographs, Flood peak, Glaciohydrology, Case studies.

Many catastrophic floods have occurred in the glacierized Karakoram Himalaya of Pakistan, some the result of river damming by landslide, others the result of river damming by glacier ice with subsequent dam failure. The 1929 outburst flood of Chong Khumdan Glacier was monitored from near the glacier for over 1500 km downstream. This data, along with some comparative observations for the smaller 1932 outburst, gives a unique record of flood-wave behavior on the Upper Indus. At the peak of the steeply rising and falling main flood peak, water discharges in excess of 22,650 cu m/sec were estimated. The mode of dam failure is critical to the size and shape of the flood wave. The breaching began through subglacial tunnels, but then carried away the entire thickness of ice above. The flood peak was highest at Sasir Brangsa, but the 1929 wave showed remarkable recuperative power in the Indus gorges, below Skardu. The significance of these floods lies especially in the exceptional risk to human communities or installations, and in their role in erosion and sedimentation. Sediment yield from the Upper Indus Basin represents the highest known rate of regional erosion over such an area, of about one meter per thousand years. Geophysical conditions create exceptional problems of monitoring. Heavy cloud cover, ruggedness and the usual problems of detail in snow-covered terrain greatly limit the usefulness of the satellite imagery presently available. More ground level surveys of danger areas, better warning networks, and redefinition of the terms of international treaties are required to lessen the danger of flood outbursts. (See also W87-07708) (Geiger-PTT)
W87-07719

CANADA CASE STUDY: CATASTROPHIC FLOODS,
Inland Waters Directorate, Ottawa (Ontario).
G. J. Young.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p

137-143, 1 fig, 5 ref.

Descriptors: *Glaciers, *Flood forecasting, *Runoff forecasting, *Canada, *Glacial lakes, Dams, Hydrologic data collection, Glacier surges, Flash floods, Flood discharge, Flood profiles, Prediction, Glaciohydrology, Flood routing, Flood control, Highways, Flood hydrographs, Simulation analysis.

Forecasting of glacier outburst floods is important in Canada due to the potential impact on the Alaskan Pipeline and Alaska Highway. Studies undertaken to determine the magnitude of the flood problem were broken down into a number of stages: an inventory of glacier-dammed lake sites; an estimation of the likely magnitude of a flood from those lakes; a selection of those lakes or lake sites which might produce significant floods and, for them, an estimation of timing of lake formation and emptying, including, in some cases, an estimate of future glacier behavior; and the superimposition of the flood event on the normal river regime, including the routing of the flood wave downstream to the highway. The hydrology of the White and Donjek river basins is presented as baseline data representing normal streamflow. Using the files of the glacier inventory of Canada to examine the Klutland basin (a sub-basin of the White River) in detail and extrapolating to larger basins using area ratios, it was estimated that there are approximately 100 to 110 glacier-dammed lake sites in the White River basin and about 80 in the Donjek basin. Lake volumes were calculated either from measurement of surface area and inference of depth or from aerial photography of empty lake basins. An empirical formula was used to derive maximum instantaneous discharge from volume. Only one lake basin at the snout of Donjek Glacier was identified as potentially hazardous. A jokulhlaup model which simulates outburst flood events was applied to the Donjek Glacier. Results of the simulation suggest that the lake basin will reform and cause jokulhlaups within the next few decades. Peak discharges would be in the range of 4000 to 6000 cu m/sec. Future flood control measures should include a complete routing of the flood wave down-valley as far as the highway. (See also W87-07708) (Geiger-PTT)
W87-07720

STANDARD PROJECT STORM PRECIPITATION AND SNOWMELT TEMPERATURE CRITERIA FOR THE 9,570-SQUARE MILE CLEARWATER RIVER DRAINAGE ABOVE SPAULDING, IDAHO,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 2B.
W87-07726

DELAYED EFFECTS OF CLOUD SEEDING WITH SILVER IODIDE,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Atmospheric Research.
For primary bibliographic entry see Field 3B.
W87-07934

MODELLING THE AREAL DEPLETION OF SNOWCOVER IN A FORESTED CATCHMENT,
Trent Univ., Peterborough (Ontario). Dept. of Geography.
J. M. Buttle, and J. J. McDonnell.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 43-60, March 1987. 11 fig, 2 tab, 16 ref.

Descriptors: *Model studies, *Forested catchments, *Snow cover, *Snowmelt, *Runoff, Ontario, Comparison studies, Prediction, Forests, Simulated, Spatial variation.

Successful modelling of snowmelt runoff from drainage basins often requires information concerning changes in the snowpack area during the course of the melt. Such data can be provided through the use of feedback models which employ the snowpack's areal extent and observed or estimated melts to forecast the snow-covered area for the subsequent day. The structure of five of these models is examined along with the results of a field study examining snowmelt and snowpack depletion in a forested catchment in south-central Ontario. The predictions of snowcover depletion for each model are compared with the observed trends for three distinct melt environments. The results suggest that several of these models can be used successfully to simulate changes in snowcover extent during snowmelt in forested areas. Snowpack depletion in areas of discontinuous snowcover is best simulated by models that assume that melt occurs predominantly at the snowpack margins, while models that utilize observed spatial variations in peak snowpack water-equivalent and assume either uniform or spatially variable melt depths perform best in environments with continuous snowcover prior to melt. (Author's abstract)
W87-08120

SHORT-TERM VARIATION OF OXYGEN ISOTOPIC COMPOSITION OF FALLING SNOW PARTICLES,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
Y. Fujiyoshi, G. Wakahama, and K. Kato.
Tellus TELLAL, Vol. 38B, No. 5, p 353-363, November 1986. 12 fig, 2 tab, 22 ref.

Descriptors: *Temporal variation, *Snow, *Oxygen isotopes, *Riming, Air temperature, Tracers, Precipitation intensity, Oxygen, Isotope studies.

Oxygen isotopic composition, crystal types and the degree of riming of falling snow particles were simultaneously observed in order to determine the possible causes of short-term variation of the delta-18O value together with the formation process of snow in clouds. The results obtained are summarized as follows: (1) Whenever the type and/or degree or riming of snow crystals changed, the delta-18O value of falling snow changed. (2) Short-term variation of the delta-18O value in each case indicated that riming has two opposite effects on the delta-18O value of snow crystals, i.e., the delta-18O value increased (or decreased) by riming. (3) There was good correlation between the maximum precipitation intensity and the range of variation in the delta-18O value of snow particles from snow bands. (4) The short-term variations of the delta-18O values are not correlated to the surface air temperature and the precipitation intensity. (Author's abstract)
W87-08304

USING GOES THERMAL INFRARED DATA TO MAP FREEZE ZONES FOR CITRUS AND CONSEQUENCES FOR WATER MANAGEMENT,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7B.
W87-08352

FINITE ELEMENT MODELING OF COUPLES HEAT AND MOISTURE TRANSPORT IN PERMAFROST,
Texas Univ. at Austin.
G. F. Carey, and L. J. Hayes.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-120931. Price codes A02 in paper copy and A01 in microfiche. Report No. 16207.24-GS, October 1982. Final Report. Army Research Office, Research Triangle Park, NC. 6 p, 26 ref. DOA Contract No. DAAG29-79-C-0081.

Descriptors: *Permafrost, *Heat transfer, *Ice, Model studies, Finite element method, Mathematical studies, Convection, Diffusion, Frozen ground, Error analysis.

The use of the finite element technique was investigated in convective heat transfer problems which involve phase change, specifically permafrost modeling. Areas of interest range from the very theoretical error estimates and development of special numerical techniques to handle phase change, to application of the techniques to specific permafrost problems. (Cassar-PTT)
W87-08363

WINTER FLOW, ICE, AND WEATHER CONDITIONS OF THE UPPER ST. LAWRENCE RIVER, 1971-1981; VOLUME III: WATER LEVEL, DISCHARGE, AND TEMPERATURE,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-08418

FROZEN SOIL CHARACTERISTICS THAT AFFECT LAND MINE FUNCTIONING,
Cold Regions Research and Engineering Lab., Hanover, NH.
P. W. Richmond.
Available from the National Technical Information Service, Springfield, Virginia 22161, as AD-A144-308. Price codes: A02 in paper copy, A01 in microfiche. Special Report 83-5, April 1983. 18 p, 9 fig, 6 tab, 10 ref. Department of the Army Project No. 4A762730AT42.

Descriptors: *Soil physical properties, *Frozen ground, *Land mines, Antitank mines, Contact mines, Soil mechanics, Mathematical equations, Model studies, Soil physics, Soil properties, Freezing, Freeze-thaw tests.

The results of an experiment to determine the effect of five factors on the load transferred through frozen soil to a buried land mine were discussed. The five factors examined were load, temperature, number of freeze-thaw cycles, soil and water content. Analysis of a half-fraction factorial experiment shows that no one variable can be used as a predictor of mine functioning performance. The results also showed that pressure mines buried in frozen soil may not function, depending on soil conditions. (Author's abstract)
W87-08493

2D. Evaporation and Transpiration

CROP WATER USE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
W. O. Pruitt, and R. L. Snyder.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 5-1 to 5-49, 11 fig, 14 tab, 32 ref.

Descriptors: *Impaired water use, *Water reuse, *Evapotranspiration, *Water use, *Cropland, *Irrigation practices, Evaporation, Preciptation, Reclaimed water, Seasonal variation, Irrigation programs.

Two of the important parameters needing evaluation in development of irrigation and storage facilities for reclaimed water irrigation systems are losses through the process of evaporation and gains from precipitation. In this chapter, procedures are developed for estimating expected losses of water through transpiration (T) by plants and evaporation (E) from plant, soil, or pond surfaces. The combined loss for a cropped surface is commonly referred to as evapotranspiration (ET). Extensive precipitation records are already available. 'Reference crop evapotranspiration', ET sub o is desribed, as the rate of evapotranspiration from an extended surafce of 8 to 15 cm (3-6 inch) tall green grass cover of uniform height, actively growing, completely shading the ground and not short of water. A term more commonly used is simply 'reference evapotranspiration' with the crop specified. An analysis of storage needs for reclaimed water projects requires consideration not of ET alone, but of the annual (and monthly) excess of ET over P. The use of only normal or average values is not adequate due to the natural variation of both; hence long-term records of ET and P are required. Also, because the two are not independent, a frequency distribution of (ET - P) cannot be developed by separate assessments of records of ET and of P; rather (ET-P) data for a number of years must be available or generated. In design the irrigation system to handle the requirements of

crops during midsummer, monthly values of ET (or ET - P for areas with summer rainfall) do not offer the necessary detail for developing peak demand information. This is especially true for shallow or sandy soils or shallow-rooted crops. Essentially, daily records of estimated ET for the months of June or July over a several-year period are needed to determine expected peak demand. Pan evaporation data on a daily basis are available from some local records. (See also W87-07662) (Lantz-PTT)
W87-07667

EFFECT OF THE DEPTH OF ATMOSPHERIC PRESSURE AND GROUND WATER FREE LYSIMETER ON THE DRAINAGE WATER DISCHARGE AND EVAPORATION (EINFLUSS DER TIEFE GRUNDWASSERFREIER LYSIMETER OHNE UNTERDRUCK DUF SICKERWASSERABLAUF; UND VERDUNSTUNG),
Humboldt-Univ. zu Berlin (German D.R.). Sektion Pflanzenproduktion.
For primary bibliographic entry see Field 2G.
W87-07799

MOUNT ST. HELENS ASH: RECREATING ITS EFFECTS ON THE STEPPE ENVIRONMENT AND ECOPHYSIOLOGY,
Washington State Univ., Pullman. Dept. of Forestry and Range Management.
R. A. Black, and R. N. Mack.
Ecology ECOLAR, Vol. 67, No. 5, p 1289-1302, October 1986. 10 fig, 1 tab, 62 ref. NSF Grants BSR-8200649 and BSR-8022134.

Descriptors: *Mount St. Helens, *Physiological ecology, *Steppes, *Ecological effects, *Volcanoes, *Ash, *Soil-water-plant relationships, Water potentials, Soil water potential, Plant water potential, Infiltration, Conductance, Conservation, Water conservation, Albedo, Energy, Radiation, Soil surfaces, Temperature, Soil temperature, Mulching, Flow, Heat flow, Physical properties, Leaves, Plant physiology, Available water, Water use, Soil water, Transpiration, Seasonal variation, Phreatophytes, Sagebrush.

The 18 May 1980 ash fall from Mount St. Helens was experimentally reproduced in May 1982 by applying silt-sized ash to a stand of the Artemisia tridentata/Agropyron spicatum association in south-central Washington. The ash caused an immediate increase in albedo from 13% to 28%, while other parameters of the energy budget were simultaneously lowered. The ash's mulching action initially increased water availability and delayed leaf abscission in Artemisia tridentata (big sagebrush) by two weeks in summer 1982. Water availability subsequently declined while water use increased. Air temperature at 0.5 m increased, latent heat flux often doubled in summer, and xylem pressure potentials decreased. Available water at the -1 m soil depth eventually decreased as much as 40%. The responses to ash were probably the maximum expressed by big sagebrush; the thin layer of ash to the east and the coarse-textured ash to the west did not significantly alter the movement of water. Short-term increases in A. tridentata in the Pacific Northwest may have been caused by similar decreases in soil temperature and increases in aridity with the deposition of Mazama ash. In addition to allowing assessment of the effects of the 1980 ash fall on arid steppe, application of ash provided an unexpected level of precision in detecting the often subtle effects that occur when some microenvironmental parameters change while the overall macroclimate remains the same. (Author's abstract)
W87-07974

XYLEM CAVITATION IN NODES AND INTERNODES OF WHOLE CHORISIA INSIGNIS H.B. ET K. PLANTS SUBJECTED TO WATER STRESS: RELATIONS BETWEEN XYLEM CONDUIT SIZE AND CAVITATION,
Messina Univ. (Italy). Ist. di Botanica.
For primary bibliographic entry see Field 2I.
W87-07999

LEAF PROPERTIES RELATED TO THE PHOTOSYNTHETIC RESPONSE TO DROUGHT IN UPLAND AND LOWLAND RICE VARIETIES,
Tohoku Univ., Sendai (Japan). Lab. of Plant Breeding.
S. Tsunoda, and M. T. Fukoshima.
Annals of Botany ANBOA4, Vol. 58, No. 4, p 531-539, October 1986. 5 fig, 1 tab, 15 ref.

Descriptors: *Leaves, *Photosynthesis, *Drought resistance, *Rice, *Plant physiology, *Soil-water-plant relationships, Drought, Flooding, Greenhouses, Transpiration, Nitrogen, Biomass, Water potentials, Leaves Water deficit.

Four upland and two lowland rice varieties were grown on flooded and dry soil in pots in a greenhouse. Photosynthetic rate (P), transpiration rate (T), and water content (W) of the second expanded leaf from the top of the main stem were measured, along with leaf area (La), dry matter content (DM), nitrogen content (N), stomatal frequency (Sf), and total vessel cross-sectional area at the base of the leaf blade (Va). P/La was positively related to T/La and Sf/La among six varieties when grown on flooded soil. Differences among varieties are discussed. Daytime leaf diffusive conductance and leaf water potential measured on the same or the same stage leaf in the greenhouse were positively correlated with the W/DM measured in the laboratory among varieties grown on dry soil. Simultaneous observation of P, T, and W in the laboratory indicated nonstomatal reduction in P/La due to leaf water deficit in sensitive varieties, although these varieties also showed a markedly lower daytime leaf diffusive conductance in the greenhouse as compared with resistant varieties. (Author's abstract)
W87-08000

WATER RELATIONS AND WATER POTENTIAL MEASUREMENTS FOR VEGETATIVE POINSETTIA,
Florida Univ., Gainesville. Dept. of Ornamental Horticulture.
For primary bibliographic entry see Field 2I.
W87-08013

WATER RELATIONS OF TWO CALIFORNIA CHAPARRAL SHRUBS,
California Univ., Davis. Dept. of Botany.
For primary bibliographic entry see Field 3B.
W87-08050

ISOTOPIC COMPOSITION OF PRECIPITATION IN TROPICAL STATIONS,
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 2B.
W87-08275

2E. Streamflow and Runoff

PREDICTION OF TEMPERATURES IN RIVERS USING A CONCEPTUAL MODEL (PREVISION DES TEMPERATURES DE L'EAU EN RIVIERE A L'AIDE D'UN MODELE CONCEPTUEL),
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 2H.
W87-07613

EVALUATION AND FORECASTING OF GROUNDWATER RUNOFF IN A SMALL WATERSHED IN MANITOBA,
E. Zaltsberg.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 69-84, March 1987. 5 fig, 5 tab, 16 ref.

Descriptors: *Groundwater forecasting, *Groundwater runoff, *Watersheds, *Surface-groundwater relations, *Statistical analysis, *Stream discharge, Wilson Creek, Basins, Prediction, Equations, Groundwater.

Observations and measurements of both the long-term groundwater regime and stream discharge were carried out in the Wilson Creek basin, southwestern Manitoba, from 1965 to 1980. Using the groundwater rating curve, monthly values of groundwater runoff from May to August were determined and analyzed. As a result of statistical analyses, probability equations which describe each monthly groundwater runoff over this period were obtained. Seasonal groundwater runoff from May to August was calculated using the groundwater rating curve as well as water balance calculations. With the exception of two years, both series of groundwater runoff values agree. During summer storm runoffs, the average groundwater contribution to stream discharge derived from groundwater depletion curves was equal to 30%, while both direct runoff and interflow accounted for 70% of stream discharge. (Author's abstract)
W87-07616

GAUGING FREQUENCY AND DETECTION OF RATING CHANGES,
Ministry of Works and Development, Christchurch (New Zealand). Hydrology Centre.
R. P. Ibbitt, and C. P. Pearson.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 85-103, March 1987. 9 fig, 3 tab, 6 ref.

Descriptors: *Streamflow, *Gaging stations, *Stream discharge, Estimating, Flow estimating, Flow, New Zealand.

For gauging stations where rating changes are frequent, errors in streamflow estimation can occur from using out-of-date stage-discharge ratings. The chance of such errors occurring can be reduced by increasing the frequency of flow gaugings. An expression for the confidence in the accuracy of a flow record is derived which depends on the time interval between gaugings. The information provided by the analysis can be used to estimate probable errors in existing records and to control future gauging operations. Application of the analysis is illustrated by a comparison of records from seven stations in New Zealand with mean flows from 2 to 200 cu m/s, and for those records, missed rating changes are the only significant contribution to the probable error of annual flows. (Author's abstract)
W87-07617

FOREST LAND: CONSERVATION NEEDS, TECHNOLOGY, AND POLICY ALTERNATIVES,
Intermountain Forest and Range Experiment Station, Boise, ID. Forestry Sciences Lab.
For primary bibliographic entry see Field 2J.
W87-07686

TECHNIQUES FOR PREDICTION OF RUNOFF FROM GLACIERIZED AREAS,
International Association of Hydrological Sciences.
For primary bibliographic entry see Field 2C.
W87-07708

OVERVIEW,
Inland Waters Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 2C.
W87-07709

OVERVIEW OF CONTEMPORARY TECHNIQUES,
Geological Survey, Tacoma, WA.
For primary bibliographic entry see Field 2C.
W87-07710

SWITZERLAND CASE STUDY: WATER SUPPLY,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Geophysik.
For primary bibliographic entry see Field 2C.
W87-07711

CANADA CASE STUDY: WATER SUPPLY,
National Hydrology Research Inst., Ottawa (Ontario).

For primary bibliographic entry see Field 2C.
W87-07712

GREENLAND CASE STUDY: WATER SUPPLY,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2C.
W87-07713

USSR CASE STUDIES: WATER SUPPLY,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 2C.
W87-07714

CHINA CASE STUDY: WATER SUPPLY,
Academia Sinica, Lanzhou (China). Lanzhou Inst. of Glaciology and Cryopedology.
For primary bibliographic entry see Field 2C.
W87-07715

PAKISTAN CASE STUDY: WATER SUPPLY,
Pakistan Water and Power Development Authority, Lahore.
For primary bibliographic entry see Field 7B.
W87-07716

USSR CASE STUDY: CATASTROPHIC FLOODS,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 2C.
W87-07717

NEPAL CASE STUDY: CATASTROPHIC FLOODS,
Nagoya Univ. (Japan). Water Research Inst.
For primary bibliographic entry see Field 2C.
W87-07718

PAKISTAN CASE STUDY: CATASTROPHIC FLOODS,
Wilfrid Laurier Univ., Waterloo (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W87-07719

CANADA CASE STUDY: CATASTROPHIC FLOODS,
Inland Waters Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 2C.
W87-07720

STANDARD PROJECT STORM PRECIPITATION AND SNOWMELT TEMPERATURE CRITERIA FOR THE 9,570-SQUARE MILE CLEARWATER RIVER DRAINAGE ABOVE SPAULDING, IDAHO,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 2B.
W87-07726

OCCURRENCE PATTERNS OF RIPARIAN PLANTS AND THEIR SIGNIFICANCE TO WATER RESOURCE DEVELOPMENT,
Wisconsin Univ.-River Falls. Dept. of Plant and Earth Sciences.
For primary bibliographic entry see Field 2H.
W87-07815

EXPERIMENTAL STUDY ON THE EFFECT OF ELEVATED TEMPERATURE ON THE HETEROTROPHIC AND AUTOTROPHIC FOOD RESOURCES OF AQUATIC INSECTS IN A FORESTED STREAM,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-07826

HYDRAULIC JUMPS AT POSITIVE AND NEGATIVE STEPS,
Ecole Polytechnique Federale de Lausanne (Switzerland).
For primary bibliographic entry see Field 8B.
W87-07862

VELOCITY DISTRIBUTION IN ALLUVIAL CHANNEL FLOW,
Karnataka Regional Engineering Coll., Suratkal (India).
B. R. Samaga, R. J. Garde, and K. G. R. Raju.
Journal of Hydraulic Research JHYRAF, Vol. 24, No. 4, p 297-308, 1986. 9 fig, 1 tab, 9 ref.

Descriptors: *Sediment transport, *Suspended load, *Alluvial channels, *Velocity distribution, *Channel flow, *Sediments, *Alluvium, *Model studies, Alluvial deposits, Channels, Flow, Mathematical equations, Mathematical models, Mathematical studies, Field tests, Rhine, Middle Rio Grande, Theoretical analysis.

The velocity distribution equations which were developed recently on the basis of data of sediment-laden flow over a rigid plane are checked with experimental data of flow over alluvial beds of sediment mixtures and found to be unsatisfactory for this case. Making use of the present set of data and the data collected by other investigators, a two-layer model of velocity distribution over alluvial beds was developed. The model shows good agreement with field measurements of the Rhine and the Middle Rio Grande. (Author's abstract)
W87-07864

PAB (PARABOLIC AND BACKWATER) AN UNCONDITIONALLY STABLE FLOOD ROUTING SCHEME PARTICULARLY SUITED FOR REAL TIME FORECASTING AND CONTROL,
Bologna Univ. (Italy).
E. Todini, and A. Bossi.
Journal of Hydraulic Research JHYRAF, Vol. 24, No. 4, p 405-424, 1986. 5 fig, 17 ref, append.

Descriptors: *Flood routing, *Flood forecasting, *Floods, *Parabolic equations, *Backwater curve, *Channels, *Rivers, *Flood control, *Dam failure, *Flood waves, Flow profiles, Backwater, Mathematical equations, Mathematical studies, Theoretical analysis, Flood flow, Forecasting, Routing.

A flood-routing scheme based upon the successive application of locally linearized parabolic equations in integral form and computation of the steady state backwater profiles (PAB) is described. The method, which is unconditionally stable as a consequence of its integral form, is shown to be particularly suited to real-time forecasting and control. The method is generally applicable to flood routing problems in mild slope channels and rivers (apart from special cases where the inertial terms play an important role) and can also be used for routing steep front waves such as those produced by dam breaks. (Author's abstract)
W87-07866

CASE HISTORY OF A FLOODING DISASTER AT A WASTEWATER TREATMENT PLANT: MCKEESPORT, PA,
McKeesport Municipal Authority Wastewater Treatment Plant, PA.
M. J. Trombola.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 20, No. 2, p 3-4, March-April 1987.

Descriptors: *Floodproofing, *Flood control, *Flood protection, *Floods, *Planning, *Wastewater facilities, Protection, Flooding, McKeesport, Pennsylvania, Youghiogheny River, Monongahela River, Disasters, Flood damage.

The McKeesport Sewage Treatment Plant, located on the confluence of the Youghiogheny and Monongahela Rivers in Pennsylvania, experienced flooding in 1972 and 1985. In 1972 the river flowed over its banks and backed up into the plant outfall. Since there was no tide gate or sluice gate on the outfall, the incoming river could not be controlled. Although the facility was unprepared for the flood, it suffered no physical or equipment damage after the major cleanup. However, the described contingency plan was developed and implemented in the 1985 flood preventing a disaster and permitting rapid return to full operations. (Wood-PTT)
W87-07867

EFFECT OF POINT AND DIFFUSE SOURCE LOADINGS ON MERCURY CONCENTRATIONS IN THE WABIGOON RIVER: EVIDENCE OF A SEASONALLY VARYING SEDIMENT-WATER PARTITION,
Ontario Ministry of the Environment, Thunder Bay (Ontario).
For primary bibliographic entry see Field 5B.
W87-07875

THREE-DIMENSIONAL DISTRIBUTION OF WINTER STONEFLY NYMPHS, ALLOCAPNIA PYGMAEA, WITHIN THE SUBSTRATE OF A SOUTHERN ONTARIO RIVER,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-07895

RELATIONSHIPS BETWEEN STREAM AND INTRAGRAVEL TEMPERATURES IN COASTAL DRAINAGES, AND SOME IMPLICATIONS FOR FISHERIES WORKERS,
Department of Fisheries and Oceans, Vancouver (British Columbia).
For primary bibliographic entry see Field 2H.
W87-07896

RESPONSE OF STREAM BENTHOS AND DRIFT TO FINE SEDIMENT DEPOSITION VERSUS TRANSPORT,
Calgary Univ. (Alberta). Aquatic Ecology Section.
For primary bibliographic entry see Field 2H.
W87-07899

ECOLOGY AND COEXISTENCE OF TWO SPECIES OF BRACHYCENTRUS (TRICHOPTERA) IN A ROCKY MOUNTAIN RIVER,
Montana Univ., Bigfork. Biological Station.
For primary bibliographic entry see Field 2H.
W87-07900

SEASONAL OCCURRENCE OF, DEVELOPMENT OF, AND THE INFLUENCES OF SELECTED ENVIRONMENTAL FACTORS ON THE LARVAE OF PROSIMULIUM AND SIMULIUM SPECIES OF BLACKFLIES (DIPTERA:SIMULIIDAE) FOUND IN THE RIVERS OF SOUTHWESTERN ALBERTA,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 2H.
W87-07901

NITROGEN METABOLISM OF THE EUTROPHIC DELAWARE RIVER ECOSYSTEM,
Harvard Univ., Cambridge, MA. Center for Earth and Planetary Physics.
For primary bibliographic entry see Field 2H.
W87-07944

COMPOSITIONS AND FLUXES OF PARTICULATE ORGANIC MATERIAL IN THE AMAZON RIVER,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 2H.
W87-07945

DISSOLVED HUMIC SUBSTANCES OF THE AMAZON RIVER SYSTEM,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 2H.
W87-07946

SIMULTANEOUS PHOTOREDUCTION AND MICROBIAL OXIDATION OF IRON IN A STREAM IN THE NEW JERSEY PINELANDS,

Rutgers - The State Univ., New Brunswick, NJ. Div. of Pinelands Research.
E. L. Madsen, M. D. Morgan, and R. E. Good.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 832-838, July 1986. 4 fig, 31 ref.

Descriptors: *Limnology, *Chemical reduction, *Biological oxidation, *Iron, *Streams, *New Jersey Pinelands, *Iron bacteria, *Bacterial physiology, Oxidation, Detection limits, Heavy metals, Temperature, Temperature effects, Sterilization, Carbon dioxide, Organic matter, Soil organic matter, Carbon radioisotopes, Microbiological studies.

Experiments were undertaken to provide physiological evidence that microorganisms are responsible for iron oxidation in the New Jersey Pinelands. Photoreduction of ferric to ferrous iron was determined in water held in bottles placed in a New Jersey Pinelands stream, although concentrations of ferrous iron in the stream itself remained below detection (15 ng/ml). The low ambient levels of ferrous iron apparently resulted from the action of iron-oxidizing microorganisms in water and soil, as shown by a temperature optimum of 20 C for, and by the inhibitory effect of sterilization upon, the disappearance of ferrous iron. Measurements of 14C-labeled CO2 incorporation into soil organic matter indicated that the iron-oxidizing microorganisms were not chemolithoautotrophs, but might have been iron-depositing bacteria or chemolithoheterotrophs. (Author's abstract)
W87-07953

FLOW-MEASURING SYSTEM FOR USE IN SMALL LAKES,
Duke Univ., Durham, NC. Dept. of Zoology.
For primary bibliographic entry see Field 7B.
W87-07956

ROLE OF LIFE HISTORY PROCESSES IN PRIMARY SUCCESSION ON AN ALASKAN FLOODPLAIN,
Alaska Univ., Fairbanks. Inst. of Arctic Biology and Museum.
For primary bibliographic entry see Field 2I.
W87-07971

ECOSYSTEM ALTERATION OF BOREAL FOREST STREAMS BY BEAVER (CASTOR CANADENSIS),
Woods Hole Oceanographic Institution, MA.
R. J. Naiman, J. M. Melillo, and J. E. Hobbie.
Ecology ECOLAR, Vol. 67, No. 5, p 1254-1269, October 1986. 5 fig, 5 tab, 65 ref. NSF Grant DEB 81-05677.

Descriptors: *Aquatic ecosystems, *Forests, *Streams, *Beavers, *Aquatic productivity, *Dam effects, *Food habits, *Ecological effects, *Drainage patterns, Rodents, Ecosystems, Dynamics, Energy, Nutrients, Hydrology, Morphology, Channel morphology, Biochemistry, Geochemistry, Quebec, Dams, Channels, Sediments, Productivity, Carbon cycle, Riffles, Organic matter, Metabolism, Particulate matter, Banks, Stream banks, Flood plains, Species diversity, Environment, Lotic environment.

The effects of beaver activity were examined on several major ecosystem components and processes in boreal forest drainage networks in Quebec. The density of dams on the small streams averaged 10.6 dams/km; the streams retain up to 6,500 cu m of sediment per dam, and the wetted surface area of the channel is increased up to several hundredfold. Beaver are also active in larger order streams, but their effects are most noticeable along riverbanks and in floodplains. Beaver ponds are important sites for organic matter processing; the stream metabolism index, a measure of ecosystem efficiency for the utilization or storage of organic inputs, is 1.63 for a pond on 2nd order Beaver Creek compared to 0.30 for the riffle upstream from it; the turnover length for particulate carbon is 1.2 km for the pond compared to 8.0 km for the riffle. Beaver-induced alterations to the structure and function of streams suggest that removal of beaver prior to 1900 had substantial effects on the dynamics of lotic ecosystems. It is suggested that current concepts of the organization and diversity of unaltered stream ecosystems in North America should recognize the keystone role of beaver, as drainage networks with beaver are substantially different in their biogeochemical economies than those without beaver. (Author's abstract)
W87-07972

NITROGEN AND PHOSPHORUS RUNOFF LOSSES FROM A NUTRIENT-POOR TROPICAL MOIST FOREST,
Colorado Univ., Boulder. Dept. of Environmental Population.
W. M. Lewis.
Ecology ECOLAR, Vol. 67, No. 5, p 1275-1282, October 1986. 3 fig, 2 tab, 37 ref. NSF Grant BSR8315410.

Descriptors: *Nitrogen, *Phosphorus, *Nutrient removal, *Runoff, *Rain forests, *Tropic zone, Forests, Climatic zones, Venezuela, Catchment basins, Forest watersheds, Seasonal variation, Ecosystems, Nutrients, Accumulation, Biomass, Runoff rates, Nitrogen fixation.

The Caura River of Venezuela drains 47,500 sq km of undisturbed tropical moist forest overlying the Guayana Shield within the Orinoco River watershed. Discharge measurements and water samples were taken of the Caura biweekly for two years. Samples were analyzed for total nitrogen, total phosphorus, and various species of these two elements. Losses of nitrogen (9.98 kg/ha/yr) and of phosphorus (0.46 kg/ha/yr) were unexpectedly high. Concentrations of total N and total P showed only minor seasonal variations, despite major seasonal changes in discharge. The data are consistent with the hypothesis that mature forested ecosystems have high yields of critical nutrients because they are not accumulating biomass. However, the data also show that this mature ecosystem strongly buffers seasonal variations in nutrient loss. (Author's abstract)
W87-07973

GROWTH AND PRODUCTION OF A STREAM STONEFLY: INFLUENCES OF DIET AND TEMPERATURE,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
For primary bibliographic entry see Field 2H.
W87-07978

SPATIAL VARIATION OF WATER TEMPERATURE CHARACTERISTICS AND BEHAVIOUR IN A DEVON RIVER SYSTEM,
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2H.
W87-08031

SPATIAL AND TEMPORAL VARIATION IN THE MACROINVERTEBRATE FAUNA OF STREAMS OF THE NORTHERN JARRAH FOREST, WESTERN AUSTRALIA: FUNCTIONAL ORGANIZATION,
Western Australia Univ., Nedlands. Centre for Water Research.
For primary bibliographic entry see Field 2H.
W87-08034

SUSPENDED BACTERIA IN CALCAREOUS AND ACID HEADSTREAMS: ABUNDANCE, HETEROTROPHIC ACTIVITY AND DOWNSTREAM CHANGE,
Hull Univ. (England). Dept. of Plant Biology.
For primary bibliographic entry see Field 2H.
W87-08035

SPECIES SEGREGATION DURING PREDATOR EVASION IN CYPRINID FISH SHOALS,
University Coll. of North Wales, Bangor. School of Animal Biology.
For primary bibliographic entry see Field 2H.
W87-08036

EFFECTS OF BARGE TRAFFIC ON DISTRIBUTION AND SURVIVAL OF ICHTHYOPLANKTON AND SMALL FISHES IN THE UPPER MISSISSIPPI RIVER,
National Fishery Research Lab., La Crosse, WI.
For primary bibliographic entry see Field 6G.
W87-08044

ECONOMIC VALUE OF INSTREAM FLOW: METHODOLOGY AND BENEFIT ESTIMATES FOR OPTIMUM FLOWS,
California Univ., Davis. Div. of Environmental Studies.
For primary bibliographic entry see Field 6D.
W87-08085

PARTIAL DURATION SERIES MODELING UNDER THE ASSUMPTION OF A POISSONIAN FLOOD COUNT,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
F. Ashkar, and J. Rousselle.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 135-144, March 1987. 2 fig, 1 tab, 20 ref, append.

Descriptors: *Depth-area-duration analysis, *Flood forecasting, *Model studies, *Partial duration series method, *Flood frequency, *Poisson distribution, Statistics, Mathematical analysis, Floods, Quebec.

Some reflection is made on certain practical aspects of the partial duration series (p.d.s.) approach to flood frequency analysis. The problem of choosing the base level or truncation level x sub 0 is addressed, and a graphical procedure for this choice, based on the equality of the mean and variance of the Poisson distribution, is proposed. With this kind of procedure, one can expect to be better able to tell how well the Poisson model for flood count will perform in a particular situation, and as the Appendix will show, will also be better justified in making the assumption of statistical independence of flood exceedances above x sub 0. It is shown how one single base level chosen according to mathematical criteria can be assigned to do the job of a number of different base levels chosen for different purposes, based on other types of criteria. Some of the results of a partial duration series analysis applied to 34 gaging stations in the Province of Quebec, Canada, are presented in order to help clarify some of the ideas raised in the study. (Author's abstract)
W87-08124

EFFECT OF PARTIAL AND CLEARCUTTING ON STREAMFLOW AT DEADHORSE CREEK, COLORADO,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
For primary bibliographic entry see Field 4C.
W87-08125

STUDY OF THERMOPHILIC CAMPYLOBACTERS IN A RIVER SYSTEM,
Preston Infirmary, (England).
For primary bibliographic entry see Field 5B.
W87-08127

CONTROL OF SURFACE RUNOFF BY SUBSURFACE INFILTRATION OF STORMWATER: A CASE STUDY IN JAPAN,
Ministry of Construction, Tokyo (Japan). River Bureau.
For primary bibliographic entry see Field 4B.
W87-08156

FLOOD POTENTIAL OF FORTYMILE WASH AND ITS PRINCIPAL SOUTHWESTERN TRIBUTARIES, NEVADA TEST SITE, SOUTHERN NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
R. R. Squires, and R. L. Young.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-014778. Price codes: A04 in paper copy, A01 in

microfiche. Water Resources Investigations Report 83-4001, 1984. 45 p, 17 fig, 5 tab, 12 ref.

Descriptors: *Fortymile Wash, *Nevada, *Flood potential, Flood peak, Mathematical studies, Mathematical analysis, Channel flow, Flow velocity.

Flood hazards for a 9-mile reach of Fortymile Wash and its principal southwestern tributaries--Busted Butte, Drill Hole, and Yucca Washes--were evaluated to aid in determining possible sites for the storage of high-level radioactive wastes on the Nevada Test Site. Data from 12 peak-flow gaging stations adjacent to the Test Site were used to develop regression relations that would permit an estimation of the magnitude of the 100- and 500-year flood peaks, in cubic feet per second. Among seven cross sections on Fortymile Wash, the estimated maximum depths of the 100-year, 500-year, and regional maximum floods are 8, 11, and 29 feet, respectively. At these depths, flood water would remain within the deeply incised channel of the wash. Mean flow velocities would be as great as 9, 14, and 28 feet per second for the three respective flood magnitudes. The study shows that Busted Butte and Drill Hole Washes (9 and 11 cross sections, respectively) would have water depths of up to at least 4 feet and mean flow velocities of up to at least 8 ft/sec during a 100-year flood. A 500-year flood would exceed stream-channel capacities at several places, with depths to 10 feet and mean flow velocities to 11 ft/sec. The regional maximum flood would inundate sizeable areas in central parts of the two watersheds. At Yucca Wash (5 cross sections), the 100-years, 500-year, and regional maximum floods would remain within the stream channel. Maximum flood depths would be about 5, 9, and 23 feet and mean velocities about 9, 12, and 22 ft/sec, respectively, for the three floods. (Author's abstract)
W87-08213

HYDROLOGIC CHARACTERIZATION OF NOSR 1.
TRW, Inc., McLean, VA. Energy and Environmental Div.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as DE84-006947. Price codes: A07 in paper copy, A01 in microfiche. DOE Report No. DOE/RA/32012-T23, March 1982. 169 p, 42 fig, 36 tab, 103 ref. DOE Contract AC01-78RA32012.

Descriptors: *Hydrologic properties, *Oil shale, *Flow profiles, *Surface-groundwater relations, *Rainfall-runoff relationships, Groundwater quality, Surface water, Water quality, Evapotranspiration, Aquifer systems, Transmissivity.

This Hydrologic Characterization report for Naval Oil Shale Reserve No. 1 (NOSR 1) summarizes and analyzes information obtained during the multi-year predevelopment program conducted for the U.S. Department of Energy. The compilation and analyses of this data define the baseline hydrologic conditions and provide important hydrologic information for input into development planning. Surface water discharge leaving NOSR 1 has been monitored by the U.S. Geological Survey since Water Year 1976. Total annual discharge has ranged from a low of 529.9 acre-feet in Water Year 1977, to a high of 18,296 acre-feet in Water Year 1979. For Water Years 1979 and 1980, total annual surface water discharge in area-inches was 7.37 (18,296 acre-feet) and 6.96 (17,269 acre-feet), respectively. A comparison of these figures to the estimated total annual precipitation of the same water years shows that between 25% and 30% of total annual precipitation leaves NOSR 1 as surface water runoff. Overall quality of surface water on NOSR 1 is good and meets the EPA's standards for drinking water. Evapotranspiration is estimated to range up to approximately 19 inches. This estimate was based on a study of an adjacent property, and adjusting values from that study for the vegetation distribution on NOSR 1. The groundwater system on NOSR 1 consists of four principal water-bearing zones. Zone 1 is found in the upper part of the Parachute Creek Member above the Big Three rich zone. This water-bearing zone, with an average thickness of about 170 feet, is generally unconfined, in contrast to the lower zones. Calculated transmissivities range from a high of 449 sq ft/day in Well 22, to a low of 1.2 sq ft/day in Well 15/16. Zone 2, located in the vicinity of the 'A' Groove, has an average thickness of 20 feet. Calculated transmissivities for this zone range from 0.9 to 105.9 sq ft/day. Zone 3 is located in the vicinity of the B-Groove. This zone has an average thickness of 70 feet and has somewhat higher calculated transmissivities and hydraulic condcutivities than those for the other three zones. Calculated transmissivities range from 10.9 to 529 sq ft/day. Zone 4 is found below the base of the R-6 zone. On NOSR 1, this zone has an average thickness of 170 feet. Generally, the calculated values of transmissivity and hydraulic conductivity are low and variable depending on geographic location. Calculated transmissivity ranges from a low of 0.8 sq ft/day at Well 15/16, to a high of 48.5 sq ft/day at Well 17. (Lantz-PTT)
W87-08215

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART I: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
K. Mahmood, M. I. Haque, A. M. Choudri, and T. Masood.
Available from the National Technical Information Center, Springfield, VA 22161. Environmental and Water Resources Program Report No. EWR-84-1, June 1984. 487 p, 18 fig, 1 tab, 41 ref, 2 append. NSF Grants ENG 76-82100 and INT-80-09474.

Descriptors: *Canals, *Pakistan, *Alluvial channels, *Channel morphology, *Hydraulic properties, *Sediment transport, Equilibrium, Sedimentation.

The research on large sand bed channels of Pakistan has been conducted under a binational U.S.A.-Pakistan Cooperative Program to obtain field data to verify and extend existing knowledge on the mechanics of alluvial channels. Field experiments were conducted under the Alluvial Channel Observation Project (ACOP) to obtain data on the hydraulic, sedimentation and morphologic aspects of alluvial channels. One of the objectives of the research program is to develop predictive relations for the behavior of straight sand bed channels flowing in an equilibrium state. In order to achieve this goal, equilibrium experiments were in a visible sediment inflow-outflow balance. To further ensure equilibrium conditions, field measurements were made only after the channel discharge had remained steady for at least two days. The present report is based on 200 equilibrium runs made on nine different canals and represents Part I of Volume IX of a series of reports dealing with the equilibrium experiments. The series is organized into 10 volumes, and its Volume I appeared in August 1980. Due to a large amount of combined data, Volume IX appears in three separate parts. (See also W87-08230 and W87-08231) (Author's abstract)
W87-08229

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART II: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
K. Mahmood, M. I. Haque, A. M. Choudri, and M. A. Malik.
Available from the National Technical Information Center, Springfield, VA 22161. Environmental and Water Resources Program Report No. EWR-84-1, June 1984. 487 p, 23 fig, 1 tab, 42 ref, 2 append. NSF Grants ENG 76-82100 and INT-80-09474.

Descriptors: *Canals, *Pakistan, *Channel morphology, *Sediment transport, *Alluvial channels, *Hydraulic properties, Sedimentation, Equilibrium.

The research on large sand bed channels of Pakistan has been conducted under a binational U.S.A.-Pakistan Cooperative Program to obtain field data to verify and extend existing knowledge on the mechanics of alluvial channels. Field experiments were conducted under the Alluvial Channel Observation Project (ACOP) to obtain data on the hydraulic, sedimentation and morphologic aspects of alluvial channels. One of the objectives of the research program is to develop predictive relations for the behavior of straight sand bed channels flowing in an equilibrium state. In order to achieve this goal, equilibrium experiments were in a visible sediment inflow-outflow balance. To further ensure equilibrium conditions, field measurements were made only after the channel discharge had remained steady for at least two days. The present report is based on 195 equilbrium runs made on seventeen different canals and represents Part II of Volume IX of a series of reports dealing with the equilibrium experiments. The series is organized into 10 volumes, and its Volume I appeared in August 1980. Due to a large amount of combined data, Volume IX appears in three separate parts. (See also W87-08229 and W87-08231) (Author's abstract)
W87-08230

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART III: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
K. Mahmood, M. I. Haque, A. M. Choudri, and H. Mehrdad.
Available from the National Technical Information Center, Springfield, VA 22161. Environmental and Water Resources Program Report No. EWR-84-1, June 1984. 446 p, 22 fig, 1 tab, 43 ref, 2 append. NSF Grants ENG 76-82100 and INT-80-09474.

Descriptors: *Canals, *Pakistan, *Alluvial channels, *Channel morphology, *Hydraulic properties, *Sediment transport, Equilibrium, Sedimentation.

The research on large sand bed channels of Pakistan has been conducted under a binational U.S.A.-Pakistan Cooperative Program to obtain field data to verify and extend existing knowledge on the mechanics of alluvial channels. Field experiments were conducted under the Alluvial Channel Observation Project (ACOP) to obtain data on the hydraulic, sedimentation and morphologic aspects of alluvial channels. One of the objectives of the research program is to develop predictive relations for the behavior of straight sand bed channels flowing in an equilibrium state. In order to achieve this goal, equilibrium experiments were in a visible sediment inflow-outflow balance. To further ensure equilibrium conditions, field measurements were made only after the channel discharge had remained steady for at least two days. The present report is based on 179 equilibrium runs made on fifteen different canals and represents Part III of Volume IX of a series of reports dealing with the equilibrium experiments. The series is organized into 10 volumes, and its Volume I appeared in August, 1980. Due to a large amount of combined data, Volume IX appears in three separate parts. (See also W87-08229 and W87-08230) (Author's abstract)
W87-08231

RIVERS OF THE AMAZON BASIN II. THE TRIBUTARIES OF THE RIO BRANCO (RIOS DA BACIA AMAZONICA II. OS AFLUENTES DO RIO BRANCO),
Instituto Nacional de Pesquisas da Amazonia, Manaus (Brazil).
For primary bibliographic entry see Field 2H.
W87-08276

DESCRIPTION OF A LOTIC ENVIRONMENT (THE FRENCH UPPER RHONE) USING DISCRIMINANT ANALYSIS ON QUALITATIVE VARIABLES (APPROCHE PAR L'ANALYSE DISCRIMINANTE SUR VARIABLES QUALITATIVES D'UN MILIEU LOTIQUE, LE HAUT RHONE FRANCAIS),
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Ecologie.
For primary bibliographic entry see Field 6G.

W87-08283

GRAPHICAL APPROACH TO PRINCIPAL COMPONENT ANALYSIS: UTILIZATION IN HYDROBIOLOGY (APPROCHE GRAPHIQUE DE L'ANALYSE EN COMPOSANTES PRINCIPALES NORMEE: UTILISATION EN HYDROBIOLOGIE),
Lyon-1 Univ., Villeurbanne (France).
For primary bibliographic entry see Field 7C.
W87-08286

WEIR FLOWS,
Wisconsin Univ.-Madison. Dept. of Mathematics.
For primary bibliographic entry see Field 8B.
W87-08318

INTERPRETATION OF TRACER DISPLACEMENT DURING INFILTRATION OF RIVER WATER TO GROUNDWATER,
Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland).
For primary bibliographic entry see Field 2A.
W87-08340

MAXIMUM LIKELIHOOD ESTIMATORS FOR THE MULTISITE LAG-ONE STREAMFLOW MODEL: COMPLETE AND INCOMPLETE DATA CASES,
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
G. Kuczera.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 641-645, April 1987. 4 tab, 18 ref, append.

Descriptors: *Streamflow forecasting, *Routing, *Data interpretation, *Streamflow models, *Model studies, *Maximum likelihood estimators, Algorithms, Covariance, Streamflow, Equations.

Two practical problems may arise when using the traditional estimators of the parameters in the multisite lag-one streamflow model: (1) the estimated covariance matrix may not be positive definite thereby preventing its decomposition, a necessary step for synthetic streamflow generation, and (2) if there are missing observations, streamflow data must be truncated to the shortest record resulting in a loss of useful information. This note draws attention to the existence of maximum likelihood estimators which overcome both problems. In the complete data case, explicit maximum likelihood estimators exist. However, in the incomplete data case, iterative maximum likelihood procedures must be used. In particular, the expectation maximization (EM) algorithm is considered in a state-space framework compatible with the multisite streamflow model; this algorithm has robust convergence properties, is simple to implement, and produces smoothed estimates of the missing data. An example is presented illustrating problems with decomposition of the traditional covariance matrix estimate and also illustrating application of the EM algorithm. (Author's abstract)
W87-08341

STUDY OF CELL MODELS: 1. A MANIFOLD CELL MODEL FOR DISTRIBUTED SURFACE RUNOFF SYSTEMS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08342

STUDY OF CELL MODELS: 2. THE EFFECT OF TIME DELAY ON THE LIMITING FORMS OF CASCADE AND MANIFOLD CELL MODEL RESPONSE FUNCTIONS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08343

STUDY OF CELL MODELS: 3. A PILOT STUDY ON THE CALIBRATION OF MANIFOLD CELL MODELS IN THE TIME DOMAIN AND IN THE LAPLACE DOMAIN,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08344

APPLICATION OF NONLINEAR FILTERING IN THE REAL TIME FORECASTING OF RIVER FLOWS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-08345

PLOTTING POSITIONS FOR HISTORICAL FLOODS AND THEIR PRECISION,
Geological Survey, Reston, VA.
R. M. Hirsch, and J. R. Stedinger.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 715-727, April 1987. 7 fig, 8 tab, 25 ref, 3 append.

Descriptors: *Flood forecasting, *Statistics, *Historic floods, *Plotting positions, *Data sets, Flood records, Estimating, Equations, Floods, History.

Plotting positions are needed for situations where, in addition to a systematically recorded annual flood series, one would have a record of any large floods which occurred during an extended historical period, if they occurred. Many of the published estimators are based on uncensored sampling theory which is not appropriate for such data sets. Here such historical and systematic flood records are viewed as resulting from a partially censored sampling experiment. Plotting positions are derived for such experiments using both classical and Bayesian viewpoints. In general, it is impossible to construct highly accurate estimates of the exceedance probabilities of the largest floods using only their rank, the number of observed historical floods, and the lengths of the historical period and the systematic record. For the largest flood, the coefficient of variation of exceedance-probability estimators is of the order of 1, as it is for complete systematic records. Examples illustrate the bias and precision of a variety of plotting position formulas. The differences among the different plotting positions are generally small in comparison to the sampling variability. However, plotting positions which are unbiased with uncensored samples are often the most biased when used with a combination of historical and systematic data. Three appendices consider the effect of misspecification of the length of the historical period, the effect of misspecification of the threshold of perception or observation level, and plotting positions for situations with several perception thresholds. (Author's abstract)
W87-08349

STEADY INFILTRATION FROM SMALL SHALLOW CIRCULAR PONDS,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
For primary bibliographic entry see Field 2F.
W87-08351

WINTER FLOW, ICE, AND WEATHER CONDITIONS OF THE UPPER ST. LAWRENCE RIVER, 1971-1981; VOLUME III: WATER LEVEL, DISCHARGE, AND TEMPERATURE,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
H. T. Shen, and P. N. D. D. Yapa.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-166280. Price codes: A09 in paper copy; and A01 in microfiche. Report No. 82-4, July 1982. 182 p, 1 fig, 2 ref, append. Contract No. NA 80RAC00147.

Descriptors: *Rivers, *Water temperature, *Water level, *Streamflow, Temperature, St. Lawrence River, Dams.

Water level, discharge, and water temperature records for stations along the St. Lawrence River between Kingston and the Moses-Saunders Power Dam are assembled for the winter months between December 1, 1971 and April 30, 1981. (Cassar-PTT)
W87-08418

EFFECT OF THE COEFFICIENTS OF DISCHARGE ON CILIATE POPULATIONS OF A RUNNING WATER CONTAMINATED BY MUNICIPAL WASTEWATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 2H.
W87-08513

EFFECTS OF ACIDIFICATION ON LIFE-HISTORY TRAITS OF THE FRESHWATER CLAM MUSCULIUM PARTUMEIUM (SAY, 1822) (BIVALVIA: PISIDIIDAE),
Virginia Univ., Charlottesville. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-08536

CHARACTERISTICS OF TEMPORARY STREAMFLOW DIVERSION AND DAMMING RIVER CHANNELS UNDER MOUNTAIN CONDITIONS,
M. A. Tsiskarishvili, U. I. Godzhiashvili, Y. E. Khechinov, G. T. Mikeladze, and G. P. Andguladze.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 543-548, September 1986. 4 fig, 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 21-25, September 1986.

Descriptors: *Streamflow diversion, *Hydraulic structures, *Diversion structures, *Rivers, Diversion tunnels, Alpine regions, Mountains, Construction methods, Construction, Dam construction, Khudoni hydrostation, Tunnel construction, Tunnels.

The construction of hydraulic structures in mountain regions is made difficult by the terrain. Narrow sites, limited fields of operation, complex transport systems to both the temporary and permanent structures under construction, and the hydrological characteristics of mountain rivers (such as high flow velocities and discharge fluctuations) are determining factors when selecting the appropriate schemes of temporarily diverting a river during construction procedures. Temporary free-flow or pressure tunnels are frequently used as solutions with selection of site, route, length and cross section determined depending on the engineering-geological conditions of the canyon walls in the region of the dam site and the design discharges of the river. Design criteria of diversion tunnels and the case study of the construction of the Khudoni hydrostation were presented. It was concluded that under conditions of a complex mountain relief, the pioneer method of damming a river with a one-sided narrowing of the gap is the best and most economical method. It was also shown that closing a gap on small and medium sized rivers by using preliminarily stockpiled soil increases the rate of filling by two to five times compared with the usual methods. The high rate of filling (1000-1200 cu m/hour or more) of the soil fractionated by layers and the correct technology of closing the gap markedly reduced erosion and evacuation by the flow. (Wood-PTT)
W87-08574

SOME RIVER RUNOFF MODELS,
For primary bibliographic entry see Field 2A.
W87-08575

MORPHOLOGICAL CLASSIFICATION OF CANALS IN NATURAL SOILS,
For primary bibliographic entry see Field 8D.
W87-08577

FLOW OVER SHARP-CRESTED PLATE WEIRS,
Concordia Univ., Loyola Campus, Montreal (Quebec). Dept. of Engineering.
For primary bibliographic entry see Field 7B.

W87-08581

2F. Groundwater

PUMPING FROM AN UNCONFINED AQUIFER CONTAINING LAYERS OF DIFFERENT HYDRAULIC CONDUCTIVITY,
Birmingham Univ. (England). Dept. of Civil Engineering.
E. S. Cookey, K. S. Rathod, and K. R. Rushton.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 43-57, March 1987. 9 fig, 8 ref.

Descriptors: *Flow, *Unconfined aquifers, *Hydraulic conductivity, *Groundwater movement, *Geohydrology, *Permeability coefficient, *Model studies, Numerical analysis, Layers, Wells, Anisotropy, Velocity, Hydrology.

The presence of layers of different hydraulic conductivity can significantly affect the flow to a well in an unconfined aquifer. Model studies are described for homogeneous and layered aquifers using finite difference numerical solutions. The flow conditions at the phreatic surface and the approach velocities to the well face are calculated and compared for the different cases. The effect of the well penetration on the discharge is also observed. The adequacy of representing a layered aquifer as an equivalent anisotropic aquifer is discussed. (Author's abstract)
W87-07614

NUMERICAL SIMULATION OF CONFINED AQUIFERS: DIRECT CALCULATION OF TRANSIENT PARAMETERS (SIMULATION NUMERIQUE DU COMPORTEMENT D'UNE NAPPE AQUIFERE CAPTIVE: ESTIMATION DIRECTE DES PROCESSUS TRANSITOIRES),
Centre de Recherches Petrographiques et Geochimiques, Nancy (France).
M. Danis, and M. Quintard.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 105-111, March 1987. 4 fig, 7 ref.

Descriptors: *Numerical simulation, *Confined aquifers, *Groundwater level, Simulation, Aquifers, Groundwater, Numerical analysis.

The classical method for the simulation of a confined aquifer consists in solving the transient problem from initial conditions. In this paper a method is described which calculates directly the parameters of the aquifer at a given time if the evolution of the groundwater level is known. (Author's abstract)
W87-07618

RESOURCE IMPACT EVALUATION OF IN-SITU URANIUM GROUNDWATER RESTORATION,
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 5G.
W87-07659

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: NITROGEN AND PHOSPHORUS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W87-07674

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: TRACE ELEMENTS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-07675

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: PATHOGENS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-07676

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: TRACE ORGANICS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-07677

QUANTITATIVE HYDROGEOLOGY: GROUNDWATER HYDROLOGY FOR ENGINEERS,
Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France).
G. de Marsily.
Academic Press, Inc., Orlando, Florida. 1986. 440 p.

Descriptors: *Geohydrology, *Groundwater movement, *Soil water, *Aquifers, *Fluid mechanics, Hydraulics, Mathematical studies, Hydrologic cycle, Darcy's law, Diffusion coefficient, Aquifer characteristics, Heat transfer, Stochastic process, Model studies, Flow profiles, Numerical analysis.

This book attempts to combine two separate themes: a description of one of the links in the chain of the water cycle inside the earth's crust, i.e., the subsurface flow, and the quantification of the various types of this flow, obtained by applying the principles of fluid mechanics in porous media. Topics covered are: the water cycle; rock porosity and fluid-solid relations in porous media; basic concepts in hydraulics; Darcy's law; integration of the elementary equations, the diffusion equation, and consolidation; aquifer systems; steady state solutions of the diffusion equation; transient solutions of the diffusion equation, pumping tests and measurements of aquifer properties; multiphase flow of immiscible fluids; flow of miscible fluids (dispersion, retention, and heat transfer); geostatistic and stochastic approach in hydrogeology; and numerical solutions of the flow and transport equations. Appendices present formulas for estimating the potential evapotranspiration and descriptions of the commonly used physical quantities. An extensive bibliography and index are included. (Geiger-PTT)
W87-07702

GEOHYDROLOGIC FACTORS AND CURRENT CONCEPTS RELEVANT TO CHARACTERIZATION OF A POTENTIAL NUCLEAR WASTE REPOSITORY SITE IN COLUMBIA RIVER BASALT, HANFORD SITE, WASHINGTON,
Atomics International Div., Richland, WA. Rockwell Hanford Operations.
R. E. Gephart, S. M. Price, R. L. Jackson, and C. W. Myers.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84014889. Price codes: A02 in paper copy, A01 in microfiche. Report No. RHO-BW-SA--326-P, November 1983. 15 p, 4 fig, 20 ref. DOE Contract DE-AC06-77RL01030.

Descriptors: *Geohydrology, *Groundwater movement, *Nuclear wastes, *Waste disposal, *Hanford, *Washington, *Columbia River, Basalt, Leakage, Vertical flow, Path of pollutants.

Geologic features are identified that may affect groundwater movement near a repository located in the Columbia River Basalt beneath the Hanford Site, Washington State. These include pathways through flow interiors, flow contacts, and bedrock structural discontinuities. Four concepts are considered to describe groundwater movement in basalt. These are: Concept A - This concept illustrates groundwater moving principally within heterogeneous, permeable flow tops separating flow interiors of relatively low vertical and horizontal permeability; Concept B - This concept is similar to Concept A except that basalt flows are crossed by bedrock structural discontinuities having potentially larger vertical permeabilities than the confining aquitards; Concept C - Represents a flow system characterized by lateral groundwater movement in flow tops bounded by basalt interiors of relatively high leakage; and Concept D - This concept superimposes bedrock structural discontinuities on Concept C. Differences between concepts principally focus on the degree of vertical leakage through basalt flow interiors. The existing geohydrologic data base is preliminary and is insufficient to conclusively support one groundwater-flow concept over another. However, it is proposed that available data tend to support the existence of distinct groundwater-flow systems having relatively low vertical leakage under low hydraulic-head gradients except where structural discontinuities are present. A number of geohydrologic characterization activities are under way to reduce the present uncertainty regarding potential groundwater pathways. (Lantz-PTT)
W87-07750

ORGANIC COMPLEXANT-ENHANCED MOBILITY OF TOXIC ELEMENTS IN LOW-LEVEL WASTES: QUARTERLY PROGRESS REPORT, JANUARY-MARCH 1984,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W87-07751

COMPUTER PROGRAM, IN FORTRAN IV-PLUS, FOR ONE-DIMENSIONAL HEAT AND MOISTURE MOVEMENT IN THE GROUND WITH AND WITHOUT ANY ARTIFICIAL HEAT SINKS OR SOURCES,
Tampere Univ. of Technology (Finland). Thermal Engineering Lab.
W. Tarnawski.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84751465. Price codes: A03 in paper copy, A01 in microfiche. Report No. UDK 550.36:662.99:621.577, 1982. 38 p.

Descriptors: *Data interpretation, *Groundwater movement, *Computer programs, *Flow patterns, *Model studies, Soil water, Temperature, Mathematical models.

This program solves the one dimensional heat and moisture flow problem in unfrozen and partially frozen soils, adjacent to a cylindrical, horizontal ground heat collector of a heat pump unit. Two different kinds of soils, silt and sand, are taken into consideration. The simple ground heat pump model takes into account Finnish weather conditions, heat requirements and cooperation with a solar collector. The model includes the phase change phenomenon, and heat and moisture migration. The solution of the mathematical model is based on a finite difference formulation. The nonlinearity of the problem and the nature of initial and boundary conditions of the third kind dictated the use of a numerical three-time level implicit finite-difference scheme to obtain a solution. This scheme is unconditionally stable and convergent. The heat and flow properties of soils are evaluated at the intermediate time level. The complications of solving a set of nonlinear algebraic equations at each time step are avoided. The coefficients of the set of simultaneous equations for a given time increment form a tridiagonal matrix. For this type of matrix, the special adaptation of the Gaussian elimination procedure is used. This method is very efficient and suitable for automatic computation. (Lantz-PTT)
W87-07753

GEOHYDROLOGY OF THE DAKOTA AQUIFER.
National Water Well Association, Worthington, OH.
Proceedings of the First C. V. Theis Conferences on Geohydrology, October 5-6, 1982, Lincoln, Nebraska. National Water Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. 247 p. Edited by Donald G. Jorgensen, and Donald C. Signor.

Descriptors: *Groundwater movement, *Aquifers, *Dakota Aquifer, *Geohydrology, *Alberta, *North Dakota, *South Dakota, *Iowa, *Nebras-

ka, *Colorado, *Kansas, *Conferences, Groundwater quality, Dissolved solids, Hydrocarbons, Chemical analysis, Geothermal studies, Groundwater.

The Dakota aquifer is one of the largest aquifers in North America and extends from northern Canada into New Mexico in the United States. The aquifer is an important source of water in parts of Alberta, Canada, and North Dakota, South Dakota, Iowa, Nebraska, Colorado and Kansas in the United States. However, the aquifer is largely undeveloped. Water quality varies significantly throughout the aquifer. Dissolved-solids concentration of the water varies from less than 1,000 to more than 100,000 parts per million; however, most of the water contains less than 10,000 parts per million of dissolved solids. The aquifer also contains hydrocarbons and is an important geothermal source. The geologic framework of the aquifer is complex and only partly defined. The geohydrologic cycle of the aquifer includes extensive vertical leakage into and out of the aquifer and extensive discharge largely by flowing wells and cross-formational flow. Aquifer definition is incomplete and controversial. Papers discussing geologic framework, aquifer naming, aquifer development, hydrodynamics and petroleum accumulation, aquifer analyses, geothermal assessment, hydrochemistry, and water use are included in the proceedings. (See also W87-07756 thru W87-07781) (Author's abstract)
W87-07755

OVERVIEW OF THE CRETACEOUS IN ALBERTA,
Alberta Dept. of Environment, Edmonton.
D. W. Prosser.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 11-13, 2 fig, 3 ref.

Descriptors: *Dakota Aquifer, *Alberta, *Cretaceous strata, *Aquifers, Geohydrology, Oil, Salinity, Geology.

In Alberta, Canada, the Dakota equivalents are Lower Cretaceous strata of the Blairmore group in the mountains and foothills, the Mannville group in the southern and central plains and the Grand Rapids and McMurray formations in the northeast. These strata are generally oil and gas bearing zones with highly saline formation waters although some fresh waters occur near the outcrop in the northeast part of the province. Throughout west and central Alberta the Upper Cretaceous strata are also oil and gas bearing while overlying Cretaceous and Tertiary sandstones are the principle aquifers. The geology, oil, gas in cretaceous strata, and groundwater in cretaceous strata, and information service and resource management concerning Cretaceous strata in Alberta are discussed in this paper. (See also W87-07755) (Author's abstract)
W87-07756

DAKOTA AQUIFER SYSTEM IN THE PROVINCE OF MANITOBA,
Manitoba Dept. of Natural Resources, Winnipeg. Water Resources Branch.
M. Rutulis.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 14-21. 7 fig, 13 ref.

Descriptors: *Dakota Aquifer, *Groundwater quality, *Geohydrology, *Aquifer systems, *Manitoba, *Aquifers, *Swan River, Carbonate rocks, Shales, Potable water, Mineralization.

The Dakota aquifer system correlates with the Lower Cretaceous Swan River formation in Manitoba. The Swan River formation occupies a triangular area extending some 250 km (150 miles) east and 500 km (300 miles) north of the southwest corner of the province. Some fairly extensive nondeposition areas exist in the southern half of the triangle. The Swan River formation is overlain by Cretaceous shales and is underlain by Jurassic shales in the southern part and by Devonian carbonate rocks in the northern part. The thickness of the formation ranges from zero to more than 100 m (330 feet). The transmissivity of the Swan River sandstone aquifers generally is low. Even in the thickest and coarsest aquifers it rarely exceeds 100 cq mi/d (7,000 I.G.P.D./ft). In most of the Swan River aquifer system water is highly mineralized. Potable water is found only in the northern part of the aquifer system where local fresh water flow systems dominate over the highly mineralized regional flow system. The main uses of water from the Swan River aquifers are for domestic, farm and municipal requirements. It is not likely that the usage will change significantly in the future. The aquifers are adequately protected from over-development and pollution by existing legislation. (Lantz-PTT)
W87-07757

GEOLOGY AND HYDROLOGY OF THE INYAN KARA FORMATION (LOWER CRETACEOUS), NORTH DAKOTA,
Shell Oil Co., Houston, TX.
For primary bibliographic entry see Field 8E.
W87-07758

GEOHYDROLOGY AND HYDROCHEMISTRY OF AQUIFERS IN CRETACEOUS ROCKS, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
H. W. Anderson, and J. F. Ruhl.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 27-37, 8 fig, 1 tab, 15 ref.

Descriptors: *Dakota Aquifer, *Geochemistry, *Groundwater quality, *Groundwater yield, *Aquifers, *Geohydrology, *Chemical analysis, *Minnesota, Geology, Cretaceous rocks, Rocks, Recharge, Infiltration, Dissolved solids, Bicarbonates, Mineralization.

Aquifers in Cretaceous-age rocks in Minnesota inlcude the Dakota formation, the Greenhorn limestone of the Colorado group, the Codell sandstone member of the Carlile shale of the Colorado group, the Windrow formation and the Coleraine formation. In most areas, the aquifers are interbedded with confining beds of shale. Recharge to these aquifers is mainly from precipitation that infiltrates the land surface and percolates through overlying drift and shale of Cretaceous age. Some water in the aquifers flows into Minnesota from North and South Dakota. Water in the aquifers is generally confined. Discharge is into the major rivers, including the Red River of the north and the Minnesota River. Dissolved-solids concentrations in groundwater, in milligrams/liter (mg/L), are generally about 2,000 in the northwest, 1,000 in the southwest and along the western border, and 500 in central and eastern Minnesota. Water in most of the 14 principal aquifers in Minnesota generally is of the calcium bicarbonate type. However, sodium chloride-type water is common in the aquifers in the northwest and calcium sulfate-or sodium sulfate-type water is common in the southwest where the Dakota formation is present. Mixed-ion water types are common throughout southwest Minnesota and along the western border, partly becuase of the inflow of highly mineralized water from the aquifers in North and South Dakota. Yields from wells in the aquifers are generally insufficient for municipal and industrial supplies, but are sufficient for domestic and stock supplies. High concentrations of dissolved solids and boron limit use of the water for irrigation. (See also W87-07755) (Author's abstract)
W87-07759

OVERVIEW OF SOUTH DAKOTA'S DAKOTA AQUIFER,
South Dakota State Geological Survey, Vermillion.
R. A. Schoon.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 38-40, 2 fig, 7 ref.

Descriptors: *Dakota Aquifers, *Aquifers, *South Dakota, *Groundwater recharge, Oil, Hydrocarbons, Geohydrology.

The aquifer in the Dakota formation that receives most of its recharge from Paleozoic rocks is the most important aquifer in the state of South Dakota. Because of this fact, agencies of the state closely monitor the development of this aquifer. There are no known oil or gas accumulations in South Dakota in the Dakota formation that are of commercial importance. A rather large area exists in the central part of the state where dry gas is produced from flowing wells that tap the Dakota formation. Near Ardmore, South Dakota, in the southern hills a small, shut-in gas field does exist. The trapping mechanism appears to be a Newcastle tongue crossing over the nose of the Chilsoin anticline. Little is known of the physical properties of the rocks in the Dakota formation and the Inyan Kara group. Few coring attempts have been made and few of these attempts have been successful. Thus core analyses are not available. The sources of recharge are discussed here, as well as the effect these recharges may have on the aquifer. (See also W87-07755) (Author's abstract)
W87-07760

DAKOTA AQUIFER SYSTEM IN THE STATE OF COLORADO,
Colorado Geological Survey, Denver.
R. H. Pearl.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 41-47, 2 fig, 2 tab, 58 ref.

Descriptors: *Dakota Aquifer, *Colorado, *Aquifer systems, *Groundwater, Geohydrology, Sandstones, Shale, Groundwater movement, Hydrocarbons, Geothermal studies, Coal, Aquifers.

The Dakota aquifer, part of the Dakota group, in Colorado consists of all rocks found between the underlying Morrison formation and the overlying Graneros shale. It is present throughout most of Colorado and contains commercial quantities of hydrocarbon, geothermal, coal and water resources. The Dakota group, of early Cretaceous age, is a complex assemblage of sandstone, shales and mudstones deposited in delta systems of the southward advancing Skull Creek seaway. The unit ranges in thickness from less than 100 feet (30 m) in the southwest part of Colorado to more than 500 feet (152 m) in the northeast part of the state. Through 1980 approximately 399 million barrels of oil and 1.2 billion mcf of natural gas have been produced from the Dakota group. Most of this amount has come from the Denver Basin. Approximately 30% of the hydrothermal systems found in the mountainous parts of the state are associated with the Dakota group. The largest hydrothermal resource associated with the Dakota group in Colorado is found in the Canon City embayment of south central Colorado. The Dakota group does not contain large quantities of commercial grade coal deposits. The only producing field in the state producing coal from the Dakota group is the Nucla-Naturita field of southwest Colorado. Locally, the Dakota aquifer is an important source of groundwater to wells. While the Dakota aquifer normally does not yield large quantities of water, in southeastern Colorado quantities of water sufficient for irrigation purposes are obtained from the Dakota aquifer. (See also W87-07755) (Author's abstract)
W87-07761

OVERVIEW OF DAKOTA AQUIFER SYSTEM IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources

Div.
M. J. Ellis.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 48-55, 6 fig, 17 ref.

Descriptors: *Aquifer systems, *Nebraska, *Dakota Aquifer, Geohydrology, Oil, Hydrocarbons, Cretaceous rocks.

The Dakota aquifer system in Nebraska is defined as those beds occurring in the stratigraphic interval between the base of the Cretaceous system and the top of the first major sandstone below the Cretaceous Greenhorn limestone. This aquifer system, which crops out along its eastern margin and lies at depths of more than 7,000 feet (2,134 m) in western Nebraska, underlies about 94% of the state. Utilization of the aquifer system is limited to two areas. In the southern part of the Nebraska panhandle, oil and natural gas are produced from sandy zones in the upper part of the Dakota aquifer system. In the eastern and northeastern parts of the state, the aquifer system is a source of water for domestic, stock, municipal and irrigation uses. (See also W87-07755) (Author's abstract)
W87-07762

AVAILABILITY AND QUALITY OF WATER FROM THE DAKOTA AQUIFER, NORTHWEST IOWA,
M. R. Burkart.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 56-57, 3 fig.

Descriptors: *Aquifers, *Dakota Aquifer, *Iowa, *Groundwater quality, Groundwater potential, Groundwater movement, Permeability coefficient, Pumping tests, Sulfates, Chemical analysis, Water yield.

The Dakota aquifer is the most extensive source of quantities of groundwater in northwestern Iowa. Lateral movement of water through the aquifer is from the north-central part of the area to the south, southwest and east. The aquifer is under water table conditions in the extreme southwestern part of the study area near the Big Sioux and Missouri rivers. Water recharges the aquifer throughout the study are through overlying confining units. The results of pumping tests in the study area indicate the hydraulic conductivity of the Dakota aquifer ranges from 37 to 50 ft/day. For purposes of estimating potential yield throughout the aquifer, 40 ft/day was multiplied by the cumulative thickness of sandstone comprising the aquifer. The resulting transmissivity determination was used to estimate the potential yield of the aquifer. Estimated potential yields to wells completed in the Dakota aquifer exceed 250 gal/min throughout much of the study area. The estimates were made assuming only 20 ft of drawdown in pumping wells. Production of greater quantities of water is possible if more than 20 ft of drawdown is acceptable. The quality of water from the Dakota is typically a calcium-magnesium sulfate type. Sulfate and dissolved solids are most abundant in the recharge areas. Sulfate concentrations commonly exceed 1,000 mg/L and dissolved solids exceed 2,000 mg/L in these areas. However, sulfate content is less than 250 mg/L in much of the area with lower hydraulic heads. Evidence, which includes observed hydrogen sulfide gas and pyrite nodules, indicates that the sulfate may be undergoing biochemical reduction within the aquifer. (See also W87-07755) (Lantz-PTT)
W87-07763

OVERVIEW OF DAKOTA AQUIFER IN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
H. E. McGovern.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 58-61, 6 fig, 4 ref.

Descriptors: *Aquifers, *Groundwater movement, *Dakota Aquifer, *Kansas, Geohydrology, Sandstones, Shales, Siltstone, Salinity.

The Dakota aquifer occurs within Lower Cretaceous rocks in the western two-thirds of Kansas. These rocks are composed of shale, siltstone and mudstone with interbedded and lenticular sandstone. Although the sandstones occur as separate units, hydrologic data indicate that there is sufficient interconnection for water movement. A large part of the aquifer is overlain by fine-grained marine deposits that retard movement, but some parts are overlain by alluvial deposits that transmit large amounts of recharge. Depth to the Dakota aquifer ranges from 2,600 feet in northwestern Kansas to less than 200 feet in the eastern part of the area and the maximum thickness is about 500 to 600 feet. Thicknesses of sandstone in the aquifer commonly are less than 100 feet in the eastern part and from 200 to 300 feet in the western part. Well yields differ greatly from one location to another and from one sandstone unit to another at the same location. Yields range from a few hundred to 1,000 gallons per minute in relation to the extent and thickness of sand, the degree of cementation and the interconnection of sand units. Generally, water in the norhtern part of the aquifer is a sodium-chloride type and in the southern and eastern parts it is a calcium-bicarbonate type. (See also W87-07755) (Author's abstract)
W87-07764

DAKOTA AQUIFER SYSTEM IN NEW MEXICO,
New Mexico Bureau of Mines and Mineral Resources, Socorro.
W. J. Stone.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 62-68, 8 fig, 30 ref.

Descriptors: *Dakota Aquifer, *New Mexico, *Aquifer systems, Geohydrology, Sandstones, Aquifers, Transmissivity, Groundwater potential, Groundwater quality.

The Dakota aquifer occurs in two major areas of New Mexico: the San Juan Basin in the northwest and the Raton Basin/Great Plains area in the northeast. In the San Juan Basin, the Dakota sandstone is generally the only unit in the aquifer. In the Raton Basin/Great Plains area, the aquifer also includes three formations: the Tucumcari shale, the Mesa Rica sandstone and the Pajarito shale, in ascending order. The Tucumcari and Pajarito are coastal shales, whereas, the Mesa Rica is an alluvial/coastal conglomerate and sandstone complex. In both areas the Dakota sandstone consists of a lower alluvial sandstone unit and an upper coastal marine sandstone unit. Other characteristics of the aquifer can be generalized for both areas. Water is confined by the presence of overlying shale. Thickness averages approximately 200 feet. Depth ranges from 0 to 5,000 feet or more. Transmisivity is generally < 50 sq ft/day. Specific conductance ranges from < 2,000 micromhos in and near recharge areas to as much as 10,000 micromhos or greater where the aquifer lies at great depth. The aquifer provides satisfactory stock, domestic, mine (San Juan Basin only), and small municipal (Raton Basin/Great Plains area only) supplies. In the San Juan Basin, dewatering of the underlying Morrison formation for uranium mining has reduced heads in that aquifer allowing poorer quality Dakota water to enter. Designation of the San Juan Basin as a declared underground water basin by the New Mexico State Engineer provides for strict management of these and other water resources in the basin. The level of energy-resource-development activity in the Raton Basin/ Great Plains area is not likely to rival that in the San Juan Basin and water resource impact should be minimal there. (See also W87-07755) (Author's abstract)
W87-07765

REGIONAL STUDY OF THE DAKOTA AQUIFER (DARTON'S DAKOTA REVISITED),
Geological Survey, Lawrence, KS. Water Resources Div.
J. O. Helgesen, D. G. Jorgensen, R. B. Leonard, and D. C. Signor.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 69-73, 6 fig, 14 ref.

Descriptors: *Dakota Aquifer, *Aquifers, *Aquifer systems, Hydrologic studies, Hydraulic head, Groundwater recharge, Geochemistry.

The Dakota aquifer is an important resource to the midwestern United States. Early work contributed significantly to the understanding of the hydrology of the system. The availability of subsequent data has led to some modifications of original concepts of the system. Previous investigations of the Dakota aquifer in several areas provide a valuable basis for current efforts in defining regional hydrology of the system. Questions remain with regard to the significance of hydraulic-head distributions, flow patterns, rates and distribution of recharge and discharge, geochemical processes, and water-quality variations. The CM RASA is addressing such questions and considers their answers as being basic to the development and management of the Dakota aquifer system. (See also W87-07755) (Lantz-PTT)
W87-07766

EVOLUTION OF FORMATION FLUIDS IN THE 'J' SANDSTONE, DENVER BASIN, COLORADO,
Exxon Co. USA, Houston, TX. East Central Exploration Div.
J. D. Ottmann.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 77-91, 19 fig, 1 tab, 16 ref.

Descriptors: *Petroleum reservoirs, *Oilfields, *Dakota Aquifer, *Hydrodynamics, *Sandstones, *Denver Basin, *Colorado, *Groundwater movement, Geohydrology, Hydrocarbons, Flow patterns, Hydrostatic pressure.

Hydrodynamic flow is a major factor in the entrapment of petroleum in the cretaceous 'J' sandstone of the Denver Basin. A distinct fluid potential minimum with two closed lows trends northeast across the geographic center of the basin. The down-dip flow of water toward these lows has enhanced the holding capacities of oil traps on the eastern and southeastern flanks of the basin and made possible gas entrapment at the Wattenburg field in the basin deep. The present regime of down-dip flow in the 'J' sandstone resulted from subhydrostatic pressures created by regional Pliocene uplift and erosion of approximately 600 m of sediment from the central area of the basin. Subhydrostatic pressures developed as a result of cooling, which contracted the fluids more than the pore volumes and elastic expansion of the pores that exceeded that of the water in them. Present hydrodynamic conditions, however, do not adequately explain the unusually low formation water salinities throughout the 'J' sandstone. Artesian flow from the rising Front Range during the Eocene may have flushed the 'J', removing previously in-place hydrocarbons and replacing most of the connate water with meteoric water, under conditions similar to those occurring east of the Black Hills today. The Denver Basin has experienced three distinct hydrodynamic states - presumed centrifugal flow during subsidence, artesian flow during early uplift and the present centripetal flow during unloading. Recognition and evaluation of these conditions are essential to the explorationist searching for subtle traps, particularly in the Rocky Mountain region. (See also W87-07755) (Author's abstract)

W87-07767

HYDRODYNAMICS OF THE WILLISTON BASIN IN THE NORTHERN GREAT PLAINS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W87-07768

HYDROGEOLOGY OF THE DAKOTA AQUIFER SYSTEM, WILLISTON BASIN, NORTH DAKOTA,
Shell Oil Co., Houston, TX.
R. D. Butler.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 99-108, 18 fig, 12 ref.

Descriptors: *Geohydrology, *Dakota Aquifer, *Williston Basin, *North Dakota, *Model studies, *Groundwater movement, Sandstones, Hydrologic processes, Porosity, Permeability coefficient, Flow profiles, Transmissivity, Leakage, Dissolved solids, Hydrodynamics.

The Dakota group (Lower Cretaceous), which includes the Inyan Kara and Newcastle formations, was studied in detail as part of a regional hydrogeologic investigation of Jurassic, Cretaceous, and Tertiary rocks in the Williston Basin. The Dakota group includes regional water-bearing sandstones that form the Dakota aquifer system. The aquifer system is 100 to 480 feet (30 to 146 m) thick and occurs at depths of 200 to 6,200 feet (60 to 1,890 m). Analysis of wireline logs was the basis for correlating stratigraphy and determining lithology, structure, thickness, depositional patterns, formation factor, porosity, and permeability. A three-dimensional, digital flow model was constructed from hydraulic data on the Madison, Dakota, and Fox Hills aquifer systems to test the conceptual model of regional flow. Groundwater flow in the Dakota aquifer is north-easterly across North Dakota. Flow patterns are controlled by: (1) distribution of transmissivity in the various depositional facies (deltaic, marine-margin, and marine); (2) leakage from underlying Paleozoic rocks; and (3) leakage to overlying Cretaceous shale in eastern North Dakota. Aquifer hydraulic conductivity ranges from 20 to 130 ft/d (6 to 40 m/d), transmissivity from 200 to 77,000 sq ft/d (20 to 715 sq m/d), and vertical hydraulic conductivity of confining layers from 8 times 10 to the the minus 8th to 9 times 10 to the minus 11th ft/sec (2.4 times 10 to the minus 8th to 2.7 times 10 to the minus 11th m/s). Geochemical trends in dissolved solids and major ions reflect the general flow pattern and areas of leakage. Insight to the hydrodynamic operation of the regional-flow system was obtained from integration of geologic, geochemical, and hydrologic data into the digital flow model. The study demonstrated that a model could adequately simulate three-dimensional flow in the Dakota aquifer system and leakage between vertically adjacent aquifer systems and confining layers. (See also W87-07755) (Author's abstract)
W87-07769

LEAKAGE AND FRACTURE PERMEABILITY IN THE CRETACEOUS SHALES CONFINING THE DAKOTA AQUIFER IN SOUTH DAKOTA,
Geological Survey, Reston, VA. Water Resources Div.
C. E. Neuzil, J. D. Bredehoeft, and R. G. Wolff.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 113-120, 7 fig, 22 ref.

Descriptors: *Dakota Aquifer, *Leakage, *Geologic fractures, *Permeability coefficient, *Shales, *Groundwater movement, *Dakota Aquifer, *South Dakota, Aquifers, Transmissivity, Geohydrology.

Numerical simulations of the virgin groundwater flow in the aquifer system in South Dakota have provided pre-development rates of leakage through the beds confining the Dakota aquifer. For the rates determinined, the necessary vertical hydraulic conductivities of the Cretaceous shale units are one to three orders of magnitude larger than the measured shale hydraulic conductivity. The low intergranular conductivity in the shale was apparently being bypassed regionally. It is hypothesized that the leakage occurred via fractures extending through the shales. Assuming the existence of discrete transmissive fractures, a simple parallel plate fracture model provides the approximate relation between fracture size and density, which explains the larger regional hydraulic conductivities. The likely average spacing between such fractures is on the order of 100 or 1,000 m. (See also W87-07755) (Author's abstract)
W87-07770

POSSIBLE RELATION BETWEEN LINEAMENTS AND LEAKAGE THROUGH CONFINING LAYERS IN SOUTH DAKOTA,
Colorado School of Mines, Golden.
K. E. Kolm, and K. D. Peter.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 121-134, 12 fig, 4 tab, 19 ref.

Descriptors: *Dakota Aquifer, *Lineaments, *Leakage, *South Dakota, *Confining beds, *Groundwater movement, *Cheyenne River, *White River, *Bad River, *Kimball Creek, *Geohydrology, Vertical flow, Aquifers.

Lineaments are present in western South Dakota as linear segments of trunk streams and tributaries, soil and vegetation tonal anomalies and topographic or drainage offsets. Because of evidence for paleotectonic activity associated with certain lineaments, these appear to represent surface expressions of major basement discontinuities. Crustal movements along these discontinuities apparently affected depositional patterns discontinuously through the past 600 million years. Accordingly, permeability and thickness of aquifers and confining beds have been affected. Hydrochemical, potentiometric and geothermal anomalies found in two aquifers correlate with surafce lineaments and it is hypothesized that there is increased leakage through the confining layers at these locations. Two areas where evidence for leakage is particularly significant were identified: (1) parts of the Kimball Creek, Bad River, White River lineament and Cheyenne River lineament where upward leakage may occur, and (2) along the Cheyenne River lineament where downward leakage may occur. (See also W87-07755) (Author's abstract)
W87-07771

PLEISTOCENE RECHARGE TO THE DAKOTA FORMATION IN LINCOLN COUNTY, SOUTH DAKOTA,
South Dakota State Geological Survey, Vermillion.
D. L. Iles.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 135-146, 11 fig, 3 tab, 20 ref.

Descriptors: *Paleohydrology, *Groundwater recharge, *Dakota Aquifer, *South Dakota, Geohydrology, Groundwater quality, Groundwater movement, Radioactive dating, Groundwater.

The Dakota formation is a complex geologic unit with equally complex hydrology. In Lincoln County, South Dakota, the formation contains water of above average quality with no source of good quality recharge. Also, unexplained water quality variations exist between the upper and lower portions of the formation. The general groundwater gradient is from north to south in the Dakota formation and recharge from glacial sediments and the Sioux quartzite presently enters the formation along its northern edge. Water from contemporary recharge sources, when compared to water in the main body of the Dakota formation, is dissimilar in quality. Most of the present formation water originated as subglacial water and/or precipitation and was emplaced directly through surface exposures of the Dakota formation and Sioux quartzite. No other model can account for a source of good quality water and a mechanism of emplacement. Interpretations of the following isotope data support this hypothesis. A date of 38,200+1,650 years B.P. for Dakota formation water was obtained using the carbon-14 method. In addition, oxygen-18/oxygen-16 and deuterium/hydrogen ratios were obtained for four Dakota formation water samples. These ratios are: -11.75, -10.25, -10.30 and -10.85 for Delta oxygen-18 and -84.5, -69.0, -69.5 and -73.0 for Delta deuterium. These ratios indicate both a cooler climate than present and no significant changes in isotope content of the water since its formation as precipitation. (See also W87-07755) (Author's abstract)
W87-07772

HYDROLOGY OF INYAN KARA AND DAKOTA-NEWCASTLE AQUIFER SYSTEM, SOUTH DAKOTA,
Geological Survey, Albuquerque, NM. Water Resources Div.
H. L. Case.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 147-165, 11 fig, 3 tab, 38 ref.

Descriptors: *Geohydrology, *Hydrologic properties, *Inyan Kara Aquifer, *Dakota Aquifer, *South Dakota, *Groundwater movement, Infiltration, Leakage, Flow patterns, Permeability coefficient, Groundwater mining.

Aggregate thickness of the Inyan Kara aquifer in South Dakota ranges from 25 to 390 feet. Recharge in this aquifer is from: (1) infiltration on the outcrop area in the Black Hills (3.9 cu ft/sec); (2) underflow south of the Black Hills from the west (0.7 cu ft/sec); (3) underflow from North Dakota (0.7 cu ft/sec); and (4) leakage from underlying units (quantity unknown). Discharge occurs by: (1) groundwater underflow into North Dakota (0.8 cu ft/sec); (2) pumpage or flow to the land surface or both for municipal, domestic and agricultural uses (32 cu ft/sec); and (3) leakage vertically and laterally into overlying and laterally adjacent units (quantity unknown). The estimated regional hydraulic conductivity of the aquifer is 120,000 ft/sec. The lower confining layer, consisting of Permian, Triassic and Jurassic sedimentary rocks, underlies the Inyan Kara Aquifer. Thickness of the lower confining layer ranges from 0 to 1,620 feet, and estimates of vertical hydraulic conductivity range from 1 times 10 to the minus 9th power to 1 times 10 to the minus 12th ft/sec. The Skull Creek confing layer, overlies the Inyan Kara aquifer and underlies the Dakota-Newcastle aquifer. Thickness ranges from 0 to 340 ft, and vertical hydraulic conductivity estimates range from 1.5 times 10 to the minus 11th to 8 times 10 to the minus 11th ft/sec. Aggregate thickness of the Dakota-Newcastle aquifer ranges from 0 to about 450 feet. Recharge to the Dakota-Newcastle aquifer in South Dakota is from: (1) underflow from the west in the area south of the Black Hills (0.7 cu ft/sec); (2) vertical leakage form underlying units (quantity unknown); (3) vertical leakage from overlying units (quantity unknown); and to a lesser extent (4) infiltration from streams and from precipitation on the outcrop area in the Black Hills (0.01 cu ft/sec). Discharge from the Dakota-Newcastle aquifer in occurs by: (1) groundwater flow into North Dakota, Iowa, Minnesota, and Nebraska (4.6 cu ft/sec); (2) pumpage for municipal, domestic, and agricultural uses (24.8 cu ft/sec); (3) flow to the land surface or overlying units through abandoned, improperly plugged and unregulated wells (25 cu ft/sec); and (4) vertical leakage into overlying units (quantity unknown). The estimated regional hydraulic conductivity of the Dakota-Newcastle aquifer in South Dakota is 0.000064 ft/sec. (See also W87-07755) (Author's abstract)

W87-07773

LOW-TEMPERATURE GEOTHERMAL RESOURCES IN THE DAKOTA AQUIFER,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. L. Sorey, and M. J. Reed.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 169-175, 4 fig, 2 tab, 19 ref.

Descriptors: *Geothermal studies, *Dakota Aquifer, *Water temperature, *Wyoming, Thermal conductivity, Aquifers, Heat transfer, Thermal energy.

Throughout large areas in the Great Plains and Wyoming basins, the Dakota Aquifer contains water at temperatures of 40 to 90 C that meets the criteria for low-temperature geothermal resources used by the U.S. Geological survey in a recent nationwide assessment. Thick sections of Upper Cretaceous shale, having low thermal conductivity, overlie the Dakota aquifer in sedimentary basins and related structural features, resulting in vertical temperature gradients of 30 to 40 C/km. In addition, measured gradients of 40 to 100 C/km above the Dakota in the Denver Basin in western Nebraska and the Kennedy Basin in south central South Dakota indicate a component of vertical convective heat transfer in those areas. Estimates from the U.S. Geological Survey of the thermal energy stored in and recoverable from the Dakota Aquifer in the Great Plains are 4,500 times 10 to the 18th power and 18 times 10 to the 18th power joules, respectively. The corresponding estimate of the thermal energy that could be used beneficially in direct-heat applications is a significant 9,000 megawatts for 30 years. (See also W87-07755) (Author's abstract)
W87-07774

HEAT FLOW AND GROUND WATER MOVEMENT IN THE CENTRAL GREAT PLAINS,
North Dakota Univ., Grand Forks.
W. D. Gosnold.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 176-181, 4 fig, 29 ref. DOE Contract DE-AS07-79ET27205 Mod. A003.

Descriptors: *Dakota Aquifer, *Geothermal studies, *Groundwater movement, *Heat transfer, *Nebraska, Thermal stratification, Aquifers, Flow profiles, Model studies, Thermal conductivity, Water temperature.

Ideally, the flow of heat from the earth's interior is determined by the thermal conditions of the upper mantle, the tectonic state of the crust and the radioactivity of the crust. However, the thermal field is frequently disturbed by various types of perturbations and one of the most common perturbations is groundwater movement. The rate of diffusion of heat in rocks is considerably less than the rate of flow of fluids in permeable zones such as aquifers and fractures, and very slow movement of water can cause significant disturbances in the subsurface temperature field. A heat-flow study of Nebraska that was conducted specifically for geothermal resource exploration indicates that groundwater movement may significantly influence the thermal regime in the central Great Plains. Finite-difference heat-flow models that include heat sources in the upper crust, perturbations from structures, lateral variation in thermal conductivity and water flow in aquifers were tested against measured heat flow and subsurface temperature data. For the panhandle region of western Nebraska, the measured heat-flow data are consistent with computer models of the thermal regime that would be produced by eastward flow in the Dakota group at a rate between 0.4 and 1 m/yr. (See also W87-07755) (Author's abstract)
W87-07775

GEOLOGY OF DAKOTA AQUIFER AND GEOTHERMAL EVALUATION AT SCOTTSBLUFF, NEBRASKA,
Nebraska Univ. at Omaha. Dept. of Geology.
J. F. Shroder, and D. J. Becker.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 182-187, 4 fig, 11 ref.

Descriptors: *Geohydrology, *Dakota Aquifer, *Geothermal studies, *Aquifers, *Scottsbluff, *Nebraska, Sandstones, Water temperature, Water quality, Permeability coefficient.

The existence of an extensive low-temperature (<100 C) geothermal resource has been demonstrated recently for the sandstone aquifers in the Dakota group and contiguous rocks of the Morrison and Sundance formations beneath the western third of Nebraska. A district heating plan using this resource has been developed and found feasible for various institutions in Scottsbluff, Nebraska. Isopachous maps and fence diagrams constructed from nearby test wells show about 100 m (330 ft) cumulative thickness of potential sandstone aquifer about 1.6 km (1 mile) beneath the site. Water in these rocks has temperatures at about 80 C and may be under artesian pressure sufficient to bring the water level in a well to within 500 to 700 m (1,640 to 2,300 ft) of the surface. Available information from several nearby wells into the formation reveals 15 to 20% porosity, 200 millidarcies (md) permeability and water quality of about 6,000 ppm dissolved solids, mostly sodium chloride and bicarbonate. Reinjection is anticipated to dispose of the low-quality geothermal water from the aquifer and to maintain formation pressure. An initial exploratory well is now viewed as essential for project continuance. (See also W87-07755) (Author's abstract)
W87-07776

ECONOMIC-LEGISLATIVE ASPECTS OF DAKOTA GEOTHERMAL, SCOTTSBLUFF, NEBRASKA,
American Geothermal Energy Associates, Inc., Omaha, NE.
For primary bibliographic entry see Field 6E.
W87-07777

HYDROCHEMISTRY OF LOWER CRETACEOUS SANDSTONE AQUIFERS, NORTHERN GREAT PLAINS,
Geological Survey, Rapid City, SD. Water Resources Div.
K. D. Peter.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 197-208, 18 fig, 1 tab, 17 ref.

Descriptors: *Dakota Aquifer, *Geochemistry, *Groundwater quality, *Chemical analysis, *Aquifers, *Sandstones, *Montana, *Wyoming, *South Dakota, Groundwater recharge, Infiltration, Dissolved solids, Chlorides, Bicarbonates, Sulfates, Leakage, Groundwater quality.

The chemistry of water from aquifers in the Lower Cretaceous sandstone aquifers of the Northern Great Plains is controlled mainly by recharge and water-mineral interactions. Rainfall and snowmelt infiltrating at the outcrop recharges the aquifers and affects the water chemistry near uplifted areas in central Montana, northeastern Wyoming and western South Dakota. Water in the aquifers near the outcrop generally has small dissolved solids and chloride concentrations (< 500 mg/L) and the principal dissolved anion usually is bicarbonate, sulfate or a combination of the two. Leakage significantly affects water chemistry in the basins and in the eastern Dakotas. In the basins, upward leakage from aquifers in Paleozoic rocks increases chloride concentrations (to more than 10,000 mg/L) in water in the Lower Cretaceous sandstone aquifers. In addition, leakage from overlying marine shales to the uppermost unit of the Lower Cretaceous sandstones also may be increasing the chloride concentration along the periphery of the Williston Basin and in the northern Powder River Basin. In the eastern Dakotas, most of the pre-Cretaceous rock units pinch out and the water from these rocks leaks upward to the aquifers in the Lower Cretaceous sandstones. Leakage of less saline water from the aquifers in the Paleozoic rocks to the more saline water in the Lower Cretaceous sandstones in this area decreases the concentrations of most ions except sulfate, calcium and magnesium, all of which increase in concentration. Sulfate concentrations increase from less than 500 mg/L to more than 1,000 mg/L in the zone of leakgage. In central South Dakota, the areal distributions of sulfate and chloride concentrations may indicate localized upward leakage through a fracture system, which may be represented by surface lineaments. (See also W87-07775) (Author's abstract)
W87-07778

HYDROGEOLOGY AND DEVELOPMENT OF THE DAKOTA AQUIFER IN SOUTHWEST KANSAS,
Southwest Kansas Groundwater Management District No. 3, Garden City.
M. T. Dealy, J. Kume, and E. D. Jenkins.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 209-220, 11 fig, 1 tab, 12 ref.

Descriptors: *Geochemistry, *Groundwater quality, *Geohydrology, *Dakota Aquifer, *Kansas, Shales, Sandstones, Aquifers, Drawdown, Transmissivity, Dissolved solids, Chemical analysis, Sulfates, Bicarbonates, Chlorides.

The Dakota formation of Early Cretaceous age underlies most of southwest Kansas, is overlain by Upper Cretaceous shales and unconsolidated deposits of Miocene (Ogallala formation) and Pleistocene age in the northern one-third of the area, and is in direct contact with unconsolidated deposits in the central one-third of the area. A hiatus occurs between the Permian red beds and the unconsolidated deposits in the southern one-third of the area. The Dakota aquifer consists of sandstone units in the Dakota formation that commonly yield from 150 to 1,210 gal/min (9 to 76 L/sec) to wells. The specific capacity ranged from 0.6 to 11 gal/min/ft of drawdown (0.2 to 2.3 L/sec/m of drawdown). Transmissivity ranged from 100 to 2,100 sq ft/d (9 to 195 sq m/d). Storage coefficient ranged from 10,000 to 4,000. Water in the Dakota aquifer is fresh to moderately saline; concentrations of dissolved solids ranged from 200 to 3,300 mg/L. Concentrations of less than 500 mg/L occurred where the aquifer is shallow, in contact with unconsolidated deposits, or near outcrops. Calcium bicarbonate and sodium bicarbonate are the most common chemical types of water. Other chemical types include sodium chloride, calcium sulfate and sodium sulfate. Water is soft to very hard as the hardness ranged from 8 to 2,000 mg/L. Overdevelopment of the Ogallala (High Plains) aquifer and adoption of Southwest Kansas Ground Water Management District No. 3 policies restricting development of the Ogallala aquifer have caused water users to begin development of the Dakota aquifer. About 100 large capacity wells and many stock and domestic wells have been completed in the Dakota aquifer. A number of wells open to both the Ogallala and Dakota aquifers also have been developed. (See also W87-07755) (Author's abstract)
W87-07779

DAKOTA AQUIFERS IN EASTERN NEBRASKA, ASPECTS OF WATER QUALITY AND USE,
Nebraska Univ., Lincoln. Conservation and Survey Div.
D. R. Lawton, O. Goodenkauf, B. V. Hanson, and F. A. Smith.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on

Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 221-228, 7 fig, 12 ref.

Descriptors: *Aquifer systems, *Dakota Aquifer, *Nebraska, *Groundwater quality, Sandstones, Aquifers, Water use, Groundwater potential, Salinity.

Sandstone aquifers of the Cretaceous age Dakota group are a source of water for many municipal, industrial, irrigation, domestic and stock wells throughout eastern Nebraska. The sandstones are used for a water supply source primarily where shallow Quaternary aquifers do not provide an adequate water supply. Thirty-seven cities and villages withdraw an estimated 6 to 8 mgd (million gallons per day) of water from the Dakota. Withdrawals for industrial purposes total about 2 mgd. Withdrawals from approximately 400 irrigation wells in the Dakota total less than 27 mgd, which is about 0.4% of the estimated amount of groundwater used for irrigation in Nebraska. The quality of water from the Dakota is a primary constraint on its use as a water supply. Water quality differs from one location to another and with depth. In one area where the Dakota is deeply buried by younger Cretaceous rocks, the water is a calcium sulfate types and the quality is quite consistent throughout the area. Where the Dakota subcrops beneath Quaternary sediments and the Dakota most likely is interconnected with the shallow groundwater system, the water quality is much more variable, but generally it is a calcium bicarbonate type. Extremely saline water occurs in some Dakota wells in parts of southeastern Nebraska. Specific reasons for the variations in water quality, especially the extremely saline water, are not completely understood. (See also W87-07755) (Author's abstract)
W87-07780

GEOHYDROLOGY AND HYDROCHEMISTRY OF THE DAKOTA AQUIFER, CENTRAL UNITED STATES,
Geological Survey, Lawrence, KS. Water Resources Div.
R. B. Leonard, D. C. Signor, D. G. Jorgensen, and J. O. Helgesen.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 229-237, 10 fig, 32 ref.

Descriptors: *Geochemistry, *Groundwater quality, *Geohydrology, *Chemical analysis, *Dakota Aquifer, Sandstones, Groundwater quality, Aquifers, Dissolved solids, Bicarbonates, Stratigraphy.

The Dakota Aquifer, composed of the Dakota sandstone and stratigraphically equivalent sandstone units of Cretaceous age, is the uppermost regional aquifer underlying the extensively developed High Plains aquifer of the midwestern United States. The concentration of dissolved solids in groundwater of the Dakota aquifer ranges from less than 500 mg/L in calcium-bicarbonate type water in the eastern outcrop area to more than 100,000 mg/L in sodium-chloride type oilfield brine in the Denver basin to the west. Preliminary maps showing the distribution of dissolved solids confirm the complex nature of the Dakota aquifer as inferred from stratigraphic and hydraulic evidence. Extensive vertical leakage through confining layers, local recharge at the truncated eastern boundary and a barrier to recharge along the western edge of the Denver basin are consistent with the distribution of hydraulic head and dissolved solids. (See also W87-07755) (Author's abstract)
W87-07781

SURVEY OF CONTAMINANT HYDROGEOLOGY IN CANADA,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W87-07803

UNDERGROUND FLOW, TRANSPORT OF POLLUTANTS. MINERALIZATION,
B. G. Kartelev.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 513-516, August 1986. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 54-56, August 1986.

Descriptors: *Computers, *Groundwater movement, *Underground flow, *Path of pollutants, *Mineralization, *Soviet Union, Groundwater pollution.

A comparison of the level of Soviet and foreign developments in underground flow shows that in the USSR theoretical developments are not inferior to foreign achievments, but there is a lack of the necessary number of programs, modern computing machinery, and processing apparatus. Regarding seepage, on the whole it is necessary to note that the theoretical level of developments in the Soviet Union is higher, but in an applied aspect Soviet science is lagging, primarily due to the insufficient use of computing machinery. (McFarlane-PTT)
W87-07845

RELATION OF LAKE BED LEAKANCE TO GEOLOGICAL PROPERTIES,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
D. S. Cherkauer, R. W. Taylor, and K. R. Bradbury.
Ground Water GRWAAP, Vol. 25, No. 2, p 135-140, March-April 1987. 3 fig, 3 tab, 15 ref. DOC Grant NA84AA-D-00065.

Descriptors: *Surface-groundwater relations, *Conductance, *Leakage, *Groundwater, *Sediments, *Lake beds, *Lakes, Aquifers, Bedrock, Mathematical equations, Mathematical studies, Lake Michigan, Prediction, Cores, Permeability coefficient.

An inverse relationship exists between the longitudinal electrical conductance and the leakance of sediments between a bedrock aquifer and a surface-water body. The empirical relationship for western Lake Michigan, first reported by Bradbury and Taylor in 1984, was refined after additional measurements. Leakance can now be predicted from longitudinal conductance with 95% confidence to within plus or minus 0.5 order of magnitude. Evidence is also presented that sediment samples collected by coring give erroneously low values for hydraulic conductivity and leakance. (Author's abstract)
W87-07847

OPTIMAL SITING OF ARTIFICIAL RECHARGE: AN ANALYSIS OF OBJECTIVE FUNCTIONS,
Wuhan Coll. of Geology, Beijing (China). Hydrogeology Research Group.
For primary bibliographic entry see Field 4B.
W87-07848

COMPUTER MODEL FOR SIMULATING WATER QUALITY AND QUANTITY IN A WELLFIELD IN AN ALLUVIAL AQUIFER,
Nebraska Univ.-Lincoln. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-07849

GRAVITY MODELING OF THE BRIMFIELD TOWNSHIP BURIED VALLEY AND ASSOCIATED AQUIFER, PORTAGE COUNTY, OHIO,
Kent State Univ., OH. Dept. of Geology.
T. E. Culek, and D. F. Palmer.
Ground Water GRWAAP, Vol. 25, No. 2, p 167-175, March-April 1987. 7 fig, 6 tab, 28 ref.

Descriptors: *Gravity studies, *Geophysics, *Data collections, *Data interpretation, *Model studies, *Groundwater, Mathematical models, Mathematical equations, Statistical analysis, Mathematical studies, Brimfield Township, Ohio, Bedrock, Topographic mapping, Mapping, Correlation analysis, Regression analysis, Sediments.

A detailed gravity survey of 295 points was conducted in Brimfield Township, Ohio to map buried bedrock topography with a higher degree of resolution than was possible by well data alone. The survey included a subset of 40 stations where both gravity and bedrock depth were determined. Partial correlation analysis allowed identification of a regional trend, and multiple linear regression led to quantitative estimates of depth to bedrock throughout the surveyed area in a manner different from the standard method of gravity interpretation that employs models of different shapes, sizes, and density contrasts. Glacial sediments range in thickness from 10 to 150 feet, with the thickest portions generally over the axis of the buried valley. Some variations in predicted versus measured bedrock depth may be a function of variation in density of the glacial sediments or of topographic effects of the buried bedrock surface. The results of the analysis led to an improved estimate for the bedrock elevation and thickness of valley fill. The interpretation has implications with regard to the volume of glacial sediments in the area and their potential productivity as sources of groundwater in the future. (Author's abstract)
W87-07851

STATISTICAL CHARACTERISTICS OF GROUND-WATER QUALITY VARIABLES,
Woodward-Clyde Consultants, Denver, CO.
For primary bibliographic entry see Field 7A.
W87-07852

STATISTICAL METHODS FOR CHARACTERIZING GROUND-WATER QUALITY,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5G.
W87-07853

ANALYSIS OF STEADY-STATE SALT-WATER UPCONING WITH APPLICATION AT TRURO WELL FIELD, CAPE COD, MASSACHUSETTS,
Geological Survey, Reston, VA.
T. E. Reilly, M. H. Frimpter, D. R. LeBlanc, and A. S. Goodman.
Ground Water GRWAAP, Vol. 25, No. 2, p 194-206, March-April 1987. 10 fig, 15 ref.

Descriptors: *Saline water intrusion, *Groundwater movement, *Saline-freshwater interfaces, *Upconing, *Wells, *Steady-state analysis, *Model studies, Mathematical models, Mathematical studies, Mathematical equations, Mathematical analysis, Saline water, Interfaces, Aquifers, Pumpage, Pumping, Finite element method, Simulation, Comparison studies, Truro, Massachusetts.

Salt-water upconing describes the phenomenon where salt water is transported vertically upward under a well in response to pumpage in a freshwater aquifer underlain by salt water. Sharp interface methods have been used unsuccessfully to describe the physics of upconing. A finite-element model is developed to simulate a sharp interface for determination of the steady-state position of the interface and maximum permissible well discharges. The model developed is compared to previously published electric-analog model results of Bennett and others (1968). Both methods are applied to a test case at Truro, Massachusetts, where maximum permissible discharges are determined by the finite-element model to range from 0.47 to 1.05 cubic feet per second for the Test Site No. 4 location. (Author's abstract)
W87-07854

TECHNIQUE TO EVALUATE AQUIFER CONSTANTS BY PUMPING TEST DATA OF A CAVITY WELL,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Irrigation and Drainage Engineering.
H. C. Sharma, H. S. Chauhan, and K. K. Singh.
Ground Water GRWAAP, Vol. 25, No. 2, p 207-211, March-April 1987. 4 fig, 12 ref.

Descriptors: *Aquifer characteristics, *Cavity wells, *Pumping tests, *Groundwater, *Mathemat-

ical equations, *Groundwater movement, Evaluation, Mathematical studies, Nonequilibrium equations, Comparison studies, Ludhiana, India, Aquifers, Wells.

Most of the solutions proposed by various workers to solve a nonequilibrium equation for the flow towards a nonpenetrating cavity well are based on the curve-matching technique or an approximate straight-line method. Another technique to solve an inverse problem is developed which is simpler and more realistic since the human judgement element is practically eliminated. It is applicable for all values of elapsed time and involves two sets of curves. The assumptions used, appropriate equations and a practical application of the theory are presented. The proposed technique was verified using the pumping data of Kanwar et al. (1979) for the aquifer of a cavity well in Ludhiana, India. A comparison of the values obtained by the proposed technique and those obtained by Kanwar for the same aquifer by the matching technique showed good agreement. (Wood-PTT)
W87-07855

MICROCOMPUTER PROGRAM FOR INTERPRETING TIME-LAG PERMEABILITY TESTS,
SRW Associates, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 7C.
W87-07856

RESULTS OF BUILDING A 12-INCH DIAMETER PRODUCTION WELL IN GRANITE,
Caswell, Eichler and Hill, Inc., West Topsham, VT.
For primary bibliographic entry see Field 4B.
W87-07859

HONDA RUNS ON GROUND WATER,
For primary bibliographic entry see Field 4B.
W87-07860

GROUNDWATER DISCHARGE FROM GLACIAL AND BEDROCK AQUIFERS AS A SOIL SALINIZATION FACTOR IN SASKATCHEWAN,
Saskatchewan Univ., Saskatoon. Saskatchewan Inst. of Pedology.
J. L. Henry, P. R. Bullock, T. J. Hogg, and L. D. Luba.
Canadian Journal of Soil Science CJSSAR, Vol. 65, No. 4, p 749-768, November 1985. 11 fig, 7 tab, 38 ref.

Descriptors: *Mathematical equations, *Salinity, *Stratigraphy, *Hydrology, *Saskatchewan, *Groundwater movement, *Saline soils, *Glacial aquifers, Soil types, Aquifers, Conductivity, Permeability coefficient, Piezometers, Pressure-measuring instruments, Chemical properties.

The stratigraphy and hydrology of saline soils were investigated at 15 sites in Saskatchewan, Canada. Nests of piezometers were installed at five sites (Series A), while at 10 sites (Series B), a single piezometer was installed in or near an aquifer. Piezometric surface data from the nests showed the potential for upward movement in all Series A sites. The electrical conductivity (EC) of water from Series A piezometers increased from the deepest to shallowest, and there was a general increase in soil EC towards the soil surface. Hydraulic conductivity of strata was measured at three sites and varied from 1.6 x 10 to the minus 7th power to 0.00032 cm/sec. It was calculated that observed salt loads for the three sites could accumulate by upward movement from the aquifer in from 500 to 5300 yr. Equations are provided for relating the approximate sodium percentage (ASP) of Series B site soils to the ASP of the aquifer, and for relating the EC of the 1:1 suspension of the stratum immediately above the aquifer to the EC of the aquifer for Series A and B sites combined. (Author's abstract)
W87-07905

TRANSIENT GROUNDWATER FLOW SURROUNDING A RECHARGE SLOUGH IN A TILL PLAIN,
Manitoba Univ., Winnipeg. Dept. of Soil Science.
J. G. Mills, and M. A. Zwarich.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 1, p 121-134, January-February, 1986. 5 fig, 6 ref.

Descriptors: *Groundwater recharge, *Groundwater movement, *Sloughs, *Till plains, *Soil science, *Drainage, Recharge, Flow, Permeability coefficient, Aquifers, Shales, Distribution, Profiles, Soil profiles, Water level, Groundwater level, Simulation analysis, Mathematical studies, Ponding, Saturated flow, Evapotranspiration, Saturation, Infiltration, Simulation.

Knowledge of the groundwater flow system around a slough aids in the resolution of conflicting opinions on slough drainage. The flow system around a typical temporary slough in a low relief till plain landscape was therefore studied. The site is located in a regional groundwater recharge area, with till of low hydraulic conductivity overlying a shale aquifer. The distribution of soil profile types in the landscape reflects a wide range of soil water regimes. Instrumentation at the site revealed an annual cycle of water levels and transient flow that was related to spring ponding of water in the slough. Numerical simulation of the flow system, under conditions of ponding, surface saturation, and evapotranspiration, helped to clarify and extend the field observations. Each depression in the landscape has a local flow system that is superimposed on the regional system. Hydraulic conductivity, water supply to the slough, and the amount and timing of infiltration and exfiltration all affect the local flow system. It is concluded that temporary sloughs, such as the one studied, do not benefit agriculture, but drainage of these sloughs raises other concerns. (Author's abstract)
W87-07909

VEGETATIONAL SUCCESSION, MANAGEMENT AND HYDROLOGY IN A BROOKLAND (THE NETHERLANDS),
Groningen Rijksuniversiteit (Netherlands). Dept. of Plant Ecology.
For primary bibliographic entry see Field 2H.
W87-08052

DERIVATIVES OF DICYCLOPENTADIENE IN GROUND WATER,
Johns Hopkins Univ., Baltimore, MD. School of Medicine.
For primary bibliographic entry see Field 5A.
W87-08063

GROUND-WATER CONCENTRATIONS OF 226RA AND 222RN IN NORTH CAROLINA PHOSPHATE LANDS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W87-08069

PENETRATION OF NITRATE FROM AGRICULTURAL SOILS INTO THE GROUNDWATER OF THE NORFOLK CHALK,
For primary bibliographic entry see Field 5B.
W87-08075

GROUNDWATER SUPPLY AND ADVANCED WATER TREATMENT IN OMAN,
For primary bibliographic entry see Field 5F.
W87-08089

FIELD STUDY OF SCALE-DEPENDENT DISPERSION IN A SANDY AQUIFER,
Toronto Univ. (Ontario). Groundwater Research Group.
For primary bibliographic entry see Field 5B.
W87-08118

INFLUENCE OF SCALE EFFECTS, HETEROGENEITY AND CONNECTIVITY OF FRACTURED AQUIFERS ON THE BEHAVIOUR OF DRILL-HOLES IN SHIELD ZONE (WEST AFRICA) (INFLUENCE DE L'EFFET D'ECHELLE, DE L'HETEROGENEITE ET DE LA CONNEXITE DES AQUIFERES FISSURES SUR LE COMPORTEMENT DES FORAGES EN ZONE DE SOCLE (AFRIQUE DE L'OUEST)),
Montpellier-2 Univ. (France). Lab. d'Hydrogeologie.
J.-P. Faillat, and C. Drogue.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 159-182, March 1987. 7 fig, 3 tab, 43 ref.

Descriptors: *Geologic fractures, *Geohydrology, *Groundwater movement, *Granite aquifers, *Pumping tests, *Aquifers, *Drill holes, *Porous media, Shield zone, Model studies, Fissures, Ivory Coast, Africa, Hydraulics, Heterogeneity.

Pumping tests executed at an experimental station in Ivory Coast equipped with drill-holes in fresh rock (37-61 m) and 23 in the weathered zone at different depths (5-15 m), permitted the evaluation of geometrical and hydraulic parameters of a fissured aquifer in granite. The interpretation of these results, by methods referring to equivalent porous media or single fracture models, showed the importance of the scale effect in relation with fracture heterogeneity in discontinuous media and the interest of the representative elementary volume (R.E.V.) concept to explain the observed phenomena. (Author's abstract)
W87-08126

ARTIFICIAL RECHARGE OF GROUNDWATER.
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 4B.
W87-08137

ARTIFICIAL RECHARGE OF GROUNDWATER,
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 4B.
W87-08138

ROLE OF ARTIFICIAL RECHARGE IN GROUNDWATER BASIN MANAGEMENT,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W87-08139

CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. J. Morel-Seytoux.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 35-67, 8 fig, 2 tab, 33 ref. NSF Grant ENG78-00733; Ministry of Agriculture and Water (Saudi Arabia) Cooperation agreeement 58-319R-8-134; Office of Water Research and Technology Contract B-207-Colorado, Agreement 14-34-0001-0260.

Descriptors: *Conjunctive, *Surface-groundwater relations, *Groundwater management, *Groundwater recharge, Water supply development, Water supply, Aquifers, Aquifer management, Artificial recharge.

It is fairly evident that in view of their very distinct and complementary nature, there is a definite advantage in conjunctive development and operations of surface and groundwaters. In regions with limited water supply, this practice is imperative. Whereas groundwater was at the start viewed as a small complementary alternative to pure reliance on stream flows (for example, in the Wadi Jizan in Saudi Arabia or in the South Platte in Colorado), gradually the point of view is changing to one in which groundwater is considered as a prime water supply. In this perspective the river flows now have a role, at least partially, of providers of recharge to the aquifer. That role cannot be played efficiently and it cannot be managed optimally without a good understanding of the hydrology of recharge. For this reason, much of this

chapter has been dedicated to a study of infiltration, redistribution, recharge, and generated stream (or basin)-aquifer interaction. Management of the resource takes place of necessity within a society, characterized by its own institutions, laws, dynamics, and inertia. Tools that can help a planner to manage such a complex system exist. Their use has been illustrated in situations that are at least highly realistic, if not real. The outcome of a work of synthesis is only as good as the parts that constitute the whole. Good planning is not possible without the proper technologic input. (See also W87-08137) (Lantz-PTT)
W87-08140

ARTIFICIAL RECHARGE: METHODS, HYDRAULICS, AND MONITORING,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 4B.
W87-08141

MODELING OF GROUNDWATER RESPONSE TO ARTIFICIAL RECHARGE,
California Univ., Irvine. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W87-08142

GROUNDWATER SAMPLING DURING ARTIFICIAL RECHARGE: EQUIPMENT, TECHNIQUES, AND DATA ANALYSES,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7A.
W87-08143

RENOVATION OF WASTEWATER WITH RAPID-INFILTRATION LAND TREATMENT SYSTEMS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 5D.
W87-08145

PATHOGEN REMOVAL FROM WASTEWATER DURING GROUNDWATER RECHARGE,
Arizona Univ., Tucson. Dept. of Microbiology.
For primary bibliographic entry see Field 5D.
W87-08146

EPA'S RESEARCH PROGRAM ON HEALTH EFFECTS OF WASTEWATER REUSE FOR POTABLE PURPOSES,
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
For primary bibliographic entry see Field 5D.
W87-08147

HEALTH ASPECTS OF GROUNDWATER RECHARGE,
Los Angeles County Sanitation Districts, Whittier, CA.
For primary bibliographic entry see Field 4B.
W87-08148

PROPOSED GROUNDWATER RECHARGE AT EL PASO, TEXAS,
Parkhill, Smith and Cooper, Inc., El Paso, TX.
For primary bibliographic entry see Field 4B.
W87-08151

BANK AND DUNE INFILTRATION OF SURFACE WATER IN THE NETHERLANDS,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands). Lab. of Organic Chemistry.
For primary bibliographic entry see Field 5G.
W87-08154

SOIL DEPOSITION OF TRACE METALS DURING GROUNDWATER RECHARGE USING SURFACE SPREADING,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
A. C. Chang, and A. L. Page.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 609-626, 8 tab, 33 ref.

Descriptors: *Soil filters, *Groundwater recharge, *Whittier Narrows, *California, *Artificial recharge, Wastewater treatment, Heavy metals, Cadmium, Chemical precipitation.

Trace metals constitute almost the entire inorganic microcontaminants of the treated wastewater effluents that are used for artificial groundwater recharge. For trace metals present in the water in suspended forms, the primary mechanism for their removal is filtration. Trace metals dissolved in the water may be reduced by adsorption at the soil surface or by chemical precipitation. Soils appear to possess a strong ability to attenuate trace metals. After almost 20 years of artificial groundwater recharge at an average annual input of 83 m in Whittier Narrows, California, trace metals of the applied water were found only in the surface 60 cm of the soil profile. At present, it is not certain how much trace metals should be permitted to deposit in the soil profile used for groundwater recharge. If any water with trace metal concentrations not exceeding the recommended upper limit for public water supply or crop irrigation is considered suitable for artificial groundwater recharge, then most treated wastewater effluents will meet the criteria. If the U.S. Environmental Protection Agency proposed cumulative metal input limits for sludge-receiving cropland soils are used as a guide, a water with Cd contents not exceeding the maximum contamination level for public water supply (0.01 mg/L) applying at 80 m/yr will reach the Cd loading limit in less than 3 years. Long-term, continuous high-rate artificial groundwater recharge, therefore, could result in substantial trace metal enrichment of the affected soil and, in turn, may render the land in question unsuitable for subsequent uses. (See also W87-08137) (Lantz-PTT)
W87-08158

PROCESSES AFFECTING THE MOVEMENT AND FATE OF TRACE ORGANICS IN THE SUBSURFACE ENVIRONMENT,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-08159

FIELD OBSERVATIONS OF ORGANIC CONTAMINANT BEHAVIOR IN THE PALO ALTO BAYLANDS,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-08160

OCCURRENCE AND MIGRATION OF CONTAMINANTS IN GROUNDWATER AT MUNICIPAL LANDFILLS ON SAND AQUIFERS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W87-08176

GEOCHEMISTRY AND SUBSURFACE CHARACTERIZATION RELATED TO THE TRANSPORT AND FATE OF INORGANIC CONTAMINANTS,
Oklahoma State Univ., Stillwater. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W87-08177

SUBSURFACE HYDROLOGIC MONITORING TO EVALUATE CONTAMINANT MIGRATION: REQUIREMENTS AND SOLUTIONS,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W87-08186

CHEMICAL INDICATORS OF LEACHATE CONTAMINATION IN GROUNDWATER NEAR MUNICIPAL LANDFILLS,
Geraghty and Miller, Inc., Syosset, NY.
For primary bibliographic entry see Field 5B.
W87-08187

MONITORING EXPERIENCES AT A FLUE GAS DESULFURIZATION SLUDGE DISPOSAL SITE: WHAT CAN BE ACHIEVED,
Baker (Michael), Jr., Inc., Beaver, PA.
For primary bibliographic entry see Field 5B.
W87-08189

APPLICATION OF PATTERN RECOGNITION TO THE EVALUATION OF CONTAMINATION FROM OIL SHALE RETORTING,
Colorado Univ. at Denver. Center for Environmental Sciences.
For primary bibliographic entry see Field 7C.
W87-08191

PRELIMINARY DESIGN FOR A SORBING TRACER TEST IN THE CULEBRA DOLOMITE AT THE H-3 HYDROPAD AT THE WASTE ISOLATION PILOT PLANT (WIPP) SITE,
INTERA Technologies, Inc., Austin, TX.
For primary bibliographic entry see Field 5B.
W87-08199

EVALUATION OF SEPTIC TANK SYSTEM EFFECTS ON GROUND WATER QUALITY,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 5B.
W87-08207

SIMULATION OF WATER FLOW IN THE UNSATURATED ZONE INCLUDING THE ROOT ZONE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2G.
W87-08214

HYDROLOGIC CHARACTERIZATION OF NOSR 1.
TRW, Inc., McLean, VA. Energy and Environmental Div.
For primary bibliographic entry see Field 2E.
W87-08215

WIPP HYDROLOGY PROGRAM WASTE ISOLATION PILOT PLANT SOUTHEASTERN NEW MEXICO,
INTERA Technologies, Inc., Austin, TX.
G. J. Saulnier, G. A. Freeze, and W. A. Stensrud.
Hydrologic Data Report 4, December 16, 1986. SAND86-7166. 441 p, 124 fig, 4 tab, 13 append.

Descriptors: *Hydrologic data, *Pumping tests, *Water levels, *Aquifers, *New Mexico, Wastewater treatment facilities, Culebra dolomite, Test wells, Hydropads.

This report contains basic hydrologic data for aquifer tests, borehole-deviation surveys, and water-level measurements performed at the Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico. This report is organized into five parts denoted A, B, C, D, and E. Part A contains hydrologic data obtained during a series of pumping tests on the Culebra Dolomite Member of the Rustler Formation at the H-11 hydropad in October 1984. Part B contains descriptions of well-development activities, acid treatment, and a 100-hour pumping test conducted at well DOE-2. Part C describes well development and hydrologic testing at WIPP wells WIPP-12, WIPP-13, WIPP-18, WIPP-19, WIPP-21, and WIPP-22. Originally drilled as stratigraphic exploration wells, the Rustler Formation was untested in these WIPP wells. Part D presents data from borehole-deviation surveys at the WIPP-site multiple-well hydropads. Most multiple-well hydropads were partially constructed before 80, except the H-11 hydropad, which was drilled in 1983. Part E presents April through October 1986 water-level data collectged from wells in the observation well network at and

near the WIPP site. The discussion includes plots obtained from the water level data for the Magenta dolomite, the Culebra dolomite, the Rustler-Salado contact zone, and the Bell Canyon Formation. Tabulations of the water levels are presented. (Lantz-PTT)
W87-08219

GROUND WATER MANUAL FOR SMALL COMMUNITIES,
Espey, Huston and Associates, Inc., Austin, TX.
B. Plauche, and W. Wojcik.
Center for Research in Water Resources Technical Report No. CRWR-183, (1983). 245 p, 49 fig, 43 tab, 29 ref, append.

Descriptors: *Groundwater management, *Community development, Management planning, Water supply, Water quality, Groundwater quality, Groundwater, Water conveyance.

According to the 1970 census, 3.6 million people in the United States live in housing without running water. Although accurate statistics are sparse, it would be fair to say that most of these people live in rural areas or in communities with fewer than 500 residents. One recent study estimated that 95% live in communities of 10,000 people or less. These people often collect water in cisterns or haul water from nearby wells, springs, ponds or streams. According to a 1978 study, the majority of these people believe that such individual water supplies are inadequate and many would participate in a community water supply system if they could afford it. One of the reasons for preferring community supplies is that individual wells have high rates of contamination. A 1968 study, for example, estimated that 18 million people in communities of 10,000 and under use contaminated water. Although some individuals accepted the notion of poor water and low cost, many individual well owners expressed a willingness to participate in a community water supply system if the increased cost could be accompanied by an improvement in water quality. By pooling resources a community may be able to either find and develop a better water source or contruct and operate treatment facilities for water obtained from the old source. The purpose of this manual is to give the leaders of small communities an introduction to the administrative and technical aspects of establishing a community water system. Presented is basic information about small water systems so community leaders can communicate more effectively with regulatory agencies, funding sources, consultants, and contractors. (Lantz-PTT)
W87-08236

ANALYSIS OF PUMPING TESTS OF THE CULEBRA DOLOMITE CONDUCTED AT THE H-3 HYDROPAD AT THE WASTE ISOLATION PILOT PLANT (WIPP) SITE,
Sandia National Labs., Albuquerque, NM.
R. L. Beauheim.
Sandia Report No. SAND86-2311, March 1987. 154 p, 59 fig, 6 tab, 33 ref, 3 append. DOE Contract DE-AC04-76DP00789.

Descriptors: *Pumping tests, *Injection wells, *Groundwater movement, *Culebra dolomite, *Hydropads, *Geohydrology, *Disposal sites, *Waste disposal, Hydraulic properties, Transmissivity, Groundwater management, Storativity.

Two pumping tests were conducted in the Culebra Dolomite Member of the Rustler Formation at the H-3 hydropad at the Waste Isolation Pilot Plant (WIPP) site. Both tests provided information on the hydraulic properties of the Culebra at the H-3 hydropad. The interpretation of these tests had three principal objectives. The first was to determine the most appropriate conceptualization of the nature of the Culebra flow system around the H-3 hydropad. The second was to quantify the hydraulic properties of the Culebra in the vicinity of the H-3 hydropad. The total system (fractures plus matrix) transmissivity of the Culebra derived from the first test is 2.9 sq ft/day; that from the second test is 2.7 sq ft/day. The fracture-to-total-system storativity ratios range from 0.03 to 0.25, indicating a relatively high degree of storage within the fractures. The highest storativity ratios were consistently found at H-3b1. Wellbore skin values are highly negative, indicating direct wellbore connection with fractures. The third objective was to quantify the average hydraulic properties of the Culebra between the H-3 hydropad and more-distant observation wells. Between H-3 and wells H-1 and H-2, the apparent transmissivity is between 0.46 and 2.5 sq ft/day, and the apparent storativity is between 0.000027 and 0.0000045. If the possible shaft-leakage effects are ignored, the apparent transmissivity between H-3 and wells WIPP-19, 21, and 22 to the north is betwen 1.1 and 2.9 sq ft/day, and the apparent storativity is between 0.000009 and 0.000029. If shaft leakage affected the responses observed at WIPP-19, 21, and 22, then the transmissivity values listed above are not representative. The wells to the north of H-3 are not so well connected hydraulically to H-3 as are DOE-1 and H-11, and provided no indications that groundwater flow was occurring primarily through fractures. The interpretations presented in this report represent an analytical approach to the understanding of large-scale tests. Calculated transmissivities and storativities are only 'apparent' values, representing the average response of large volumes of aquifer to a stress imposed at a certain location. (Lantz-PTT)
W87-08243

WIPP HYDROLOGY PROGRAM WASTE ISOLATION PILOT PLANT SOUTHEASTERN NEW MEXICO: HYDROLOGIC DATA REPORT 3.
INTERA Technologies, Inc., Austin, TX.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE86-015377. Price codes: A99 in paper copy; and A01 in microfiche. Sandia National Laboratory Contractor Report No. SAND86-7109, June 1986. 688 p, 124 fig, 6 tab, 31 ref, 25 append. DOE Contract DE-AC04-76DP00789.

Descriptors: *Hydrologic properties, *New Mexico, *Pumping tests, *Groundwater movement, *Aquifer testing, Groundwater management, Groundwater level, Anisotropy, Culebra dolomite, Observation wells.

Hydrologic Data Report 3 contains basic hydrologic data for aquifer tests and water level measurements performed at the Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico over the period 1984 through 1986. This report is organized into six parts denoted A, B, C, D, E, and F. Part A contains hydrologic data obtained during the H-3 multipad pumping test of the Culebra dolomite October 15, 1985 through April 12, 1986. The test included a 62-day pumping period during which fluid-pressure data were collected using automated Data-Acquisition Systems at the H-3 hydropad and observation wells DOE-1, H-11b3, H-2c, and H-4b. Part B is an account of anisotropy and convergent-flow tracer testing conducted from April to June 1984 at the H-3 hydropad, providing a description of test equipment, a short history of the testing, and plots of the data. Part C contains a description of a six-day aquifer test conducted in the Culebra dolomite at the H-8 hydropad in December 1985. The test consisted of 72 hours of pumping at approximately six gallons per miute, followed by a 72-hour recovery period. Part D contains a description of a six-day aquifer test conducted in the Culebra dolomite at the H-7 hydropad in February, 1986. The test consisted of 72 hours of pumping at approximately 81.5 gallons per minute, followed by a 72-hour recovery period. Part E reports basic data collected during open-hole testing conducted by Sandia National Laboratories during the drilling of well DOE-2 from August 1984 through July 1985. Hydrologic testing was performed in four phases; three phases of drillstem, pulse, and slug testing of the Rustler, Salado, and Bell Canyon Formations, and a pumping test of the Culebra Dolomite Member of the Rustler Formation. Part F presents November 1985 through April 1986 water level data collected from wells in the observation-well network at and near the WIPP site, including plots obtained from the water-level data for the Magenta, the Culebra, the Rustler-Salado contact zone, the Bell Canyon Formation, and the Salado/Castile Formations. (Lantz-PTT)
W87-08245

BIODEGRADATION OF CRESOL ISOMERS IN ANOXIC AQUIFERS,
Oklahoma Univ., Norman. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5B.
W87-08292

MULTIGRID MODEL FOR STEADY FLOW IN PARTIALLY SATURATED POROUS MEDIA,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W87-08330

BOUNDARY ELEMENT - FINITE ELEMENT PROCEDURE FOR POROUS AND FRACTURED MEDIA FLOW,
Pennsylvania State Univ., University Park. Dept. of Mineral Engineering.
D. Elsworth.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 551-560, April 1987. 9 fig, 1 tab, 21 ref.

Descriptors: *Groundwater movement, *Geologic features, *Data interpretation, *Flow, *Aquifers, *Boundary elements, Turbulent flow, Reynolds numbers, Fissures, Porous media, Equations.

A coupled boundary element-finite element procedure is presented for linear and nonlinear fluid flow simulation in porous and fractured aquifers. Quadratic variation of both element geometry and fundamental singularity is used in the constitutively linear direct boundary element formulation. Compatible 3- to 9-noded Lagrangian finite elements are used to represent the plane flow domain for mixed linear and nonlinear flows, alike. Nodes on the external contour of the boundary element domain are only retained if flux boundary conditions are not prescribed, thus resulting in reduced matrix dimension. The geometric conductance of the linear boundary element region is evaluated only once. The resulting system matrices remain sparse, positive definite, and may be arranged for symmetry. Nonlinearity, in this context, is restricted to turbulent flow at high Reynolds numbers, although other nonlinearities may be easily accommodated using a similar procedure. A Missbach relationship is implemented to represent turbulent flow in rock fractures. Turbulent effects are confined to the finite element domain, and the resulting nonlinear equations are solved by direct iteration. Validation studies are completed against analytical solutions to linear and nonlinear flow problems. Excellent agreement is obtained with relatively sparing nodal coverage. (Author's abstract)
W87-08331

DEPTH-AVERAGING EFFECTS ON HYDRAULIC HEAD FOR MEDIA WITH STOCHASTIC HYDRAULIC CONDUCTIVITY,
Geological Survey, Denver, CO.
R. L. Naff, and A. V. Vecchia.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 561-570, April 1987. 8 fig, 14 ref, 2 append.

Descriptors: *Groundwater movement, *Model studies, *Stochastic process, *Hydraulic conductivity, *Permeability coefficient, *Porous media, Head, Flow, Distribution, Groundwater, Statistics.

Hydraulic conductivity of a porous medium frequently is considered to be a single realization of a three-dimensional spatial stochastic process. The most common observations of flow in porous media are hydraulic-head measurements obtained from wells which are screened over extensive sections of the medium. These measurements represent, approximately, a one-dimensional spatial average of the actual three-dimensional head distribution, the actual head distribution being a stochastic process resulting from flow through a random hydraulic-conductivity field. This paper examines, via ensemble averages, the effect of such spatial averages of groundwater flow on the spatial autocovariance function for a simple, yet viable, sto-

chastic model of a bounded medium. The model is taken to be three-dimensional flow in a medium that is bounded above and below and in which the hydraulic conductivity is a second-order stationary stochastic process. Spatial averaging of the hydraulic heads is considered to take place over the entire thickness of the medium. Ensemble variances and autocorrelations for depth-averaged heads are computed for the resulting two-dimensional flow system and compared with those from a fully three-dimensional flow system. (Author's abstract)
W87-08332

CARBON AND ISOTOPE MASS BALANCE MODELS OF OASIS VALLEY - FORTYMILE CANYON GROUNDWATER BASIN, SOUTHERN NEVADA,
California Univ., Berkeley. Lawrence Berkeley Lab.
A. F. White, and N. J. Chuma.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 571-582, April 1987. 11 fig, 2 tab, 29 ref.

Descriptors: *Groundwater movement, *Tracers, *Carbon isotopes, *Model studies, *Oasis Valley, *Groundwater recharge, *Oxygen isotopes, Groundwater, Aquifers, Nevada, Deuterium, Carbon dioxide, Ions, Prediction.

Environmental isotopes and carbon chemistry provide means of differentiating various recharge areas, flow paths, and ages of groundwater in portions of the Nevada Test Site and vicinity. Regional deltaD/delta18O trends are offset from the present-day meteoric line by a deuterium depletion of 5%, suggesting paleoclimatic changes. Partial pressures of CO2 and the 18O and 13C data indicate solubility and isotopic equilibrium between the gas and water in the soil zone with progressive exchange with underlying groundwater in the shallow alluvium of Oasis Valley. Application of a closed system CO2 model using the EQ3NR/EQ6 reaction path simulator successfully reproduces chemical compositions observed in the alluvium in the Amargosa Desert and in the deep tuff aquifer beneath Pahute Mesa and Yucca Mountain. Initial P sub CO2 input to the soil zone during recharge was calculated to range from 0.03 to 0.10 atm, which is comparable to measured soil CO2 pressures in Oasis Valley. Results are compared for 14C ages using the delta13C dilution correction and mass action correction term relating predicted and calculated ionic activity products of CaCO3. Results are generally comparable with discrepancies attributed to anomalous delta13C values. (Author's abstract)
W87-08333

EVALUATION OF A GROUNDWATER CORRECTIVE ACTION AT THE CHEM-DYNE HAZARDOUS WASTE SITE USING A TELESCOPIC MESH REFINEMENT MODELING APPROACH,
GeoTrans, Inc., Herndon, VA.
For primary bibliographic entry see Field 5G.
W87-08337

PARAMETRIC MODEL FOR CONSTITUTIVE PROPERTIES GOVERNING MULTIPHASE FLOW IN POROUS MEDIA,
For primary bibliographic entry see Field 2G.
W87-08338

INTERPRETATION OF TRACER DISPLACEMENT DURING INFILTRATION OF RIVER WATER TO GROUNDWATER,
Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland).
For primary bibliographic entry see Field 2A.
W87-08340

SIMULATION OF CONTAMINANT TRANSPORT IN THREE DIMENSIONS: 1. THE ALTERNATING DIRECTION GALERKIN TECHNIQUE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 7C.
W87-08346

SIMULATION OF CONTAMINANT TRANSPORT IN THREE DIMENSIONS: 2. DIMENSIONALITY EFFECTS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 7C.
W87-08347

STEADY INFILTRATION FROM SMALL SHALLOW CIRCULAR PONDS,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
G. J. Weir.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 733-736, April 1987. 1 tab, 12 ref, append.

Descriptors: *Surface-groundwater relations, *Mathematical equations, *Infiltration, *Ponds, *Reviews, *Steady flow, Infiltrometers, Estimating, Soil properties, Flow.

R. A. Wooding's (1968) analysis of steady infiltration from a shallow circular pond is reviewed and extended. A new approximation is obtained for the total steady flow of water into the soil from ponds with small radii. The main result is the approximation F* = 4 pi sin squared (a/(a pi sin a cos a + 2a sin squared a ln a - a cubed(1 + 2 psi(3/2)))), which is accurate to within 2% for a less than 0.4. Here F* approximates the dimensionless flow from the pond, and a is the usual dimensionless pond radius. This result may be significant to ring infiltrometers, since substantial errors in estimates for apparent soil properties result for moderate values of a if the accurate approximation F* is replaced by the well-known approximation 4 + 2 pi a. The presence of a logarithmic term in this expansion indicates that flows from surface sources have a different analytic structure than those from buried sources. (Author's abstract)
W87-08351

RADIONUCLIDE SORPTION AND DESORPTION MECHANISMS IN INTERBED/GROUNDWATER SYSTEMS OF THE COLUMBIA RIVER BASALT FORMATION,
Atomics International Div., Richland, WA. Rockwell Hanford Operations.
For primary bibliographic entry see Field 5B.
W87-08416

GROUND-WATER PROTECTION STRATEGY.
Environmental Protection Agency, Washington, DC. Office of Ground-Water Protection.
For primary bibliographic entry see Field 5G.
W87-08495

EXAMPLE OF AUTOMATIC CONTROL OF WATER QUALITY (UN EXEMPLE DE CONTROLE AUTOMATIQUE DE LA QUALITE DES EAUX),
Service des Eaux, Services Industriels de Geneve (Switzerland).
For primary bibliographic entry see Field 5G.
W87-08518

SELF-PURIFICATION CAPABILITY OF KARST UNDERGROUND WATERCOURSES WITH RESPECT TO THE POLLUTION OF THE MEDITERRANEAN SEA,
Andrija Stampar School of Public Health, Zagreb (Yugoslavia).
For primary bibliographic entry see Field 5B.
W87-08563

DRAINAGE OF SLOPING LANDS WITH CONSTANT REPLENISHMENT,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Irrigation and Drainage Engineering.
For primary bibliographic entry see Field 2G.
W87-08585

MODELING SATURATED-UNSATURATED WATER FLOW IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W87-08587

SCREENING METHOD FOR CONTAMINANT PLUME CONTROL,
Illinois State Water Survey, Champaign. Ground-Water Section.
For primary bibliographic entry see Field 5B.
W87-08592

STRATEGY FOR MANAGING DEPLETED AQUIFERS,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 4B.
W87-08594

COMPARISON OF THREE GROUNDWATER MODELING STUDIES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. McLaughlin, and W. K. Johnson.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 405-421, May 1987. 9 fig, 1 tab, 11 ref.

Descriptors: *Aquifers, *Model studies, *Groundwater, *San Juan basin, *Computer models, Comparison studies, New Mexico, Performance evaluation, Pumping tests, Prediction.

Three groundwater modeling studies of a water rights dispute in the San Juan basin of New Mexico are compared. Although these studies all use the same computer model and rely on the same data base, the conclusions they reach are very different. The discrepancies appear to be due primarily to different interpretations of the pump test data used to estimate aquifer parameters in the vicinity of a proposed well field. Since none of the modeling studies attempts to estimate the effect of ambiguous data interpretations on predicted drawdowns, there is no way to judge the relative value of the conflicting results. Although this outcome is disturbing it is not unusual. The credibility of such modeling studies could be greatly improved if they explicitly addressed the factors that control and limit model accuracy. (Author's abstract)
W87-08597

2G. Water In Soils

USE OF PRECIPITATION DATA TO IDENTIFY SOIL MOISTURE PATTERNS AND THE GROWING SEASONS IN EASTERN KENYA,
National Range Research Station, Makindu (Kenya).
For primary bibliographic entry see Field 2B.
W87-07609

TESTING OF LATERAL WATER FLOW IN A MOISTURE BARRIER,
Los Alamos National Lab., NM.
For primary bibliographic entry see Field 4B.
W87-07678

QUANTITATIVE HYDROGEOLOGY: GROUNDWATER HYDROLOGY FOR ENGINEERS,
Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France).
For primary bibliographic entry see Field 2F.
W87-07702

GAS CHROMATOGRAPHIC MEASUREMENT OF NITROGEN REMOVAL ACTIVITY BELOW THE MARSHY SOILS IN THE FEDERAL REPUBLIC OF GERMANY THROUGH A DRAINAGE TUBE (MESSUNG DER DENITRIFIKATIONS-AKTIVITAT VON DRAINIERTEN NIEDERMOORBODEN DER DDR MIT HILFE DER GASCHROMATOGRAPHIE),

Institute fuer Duengungsforschung Leipzig-Potsdam, Leipzig (German D.R.).
H. Lippold, I. Forster, and H. Kading.
Archiv fuer Acker- und Pflanzenbau und Bodenkunde AAPBCE, Vol. 30, No. 4, p 195-200, 1986. 1 fig, 3 tab, 6 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Nitrogen removal, *Marshy soil, *Mineral soil, *Gas chromatography, Soil types, Organic matter, Nitrogen.

Nitrogen removal activities in marshy and mineral soils of the Federal Republic of Germany were determined at 15 C using gas chromatographic procedure under helium atmosphere. These measurements were carried out at various depths, up to 80 cm and 0-100 cm for marshy and mineral soils, respectively. The results indicate that inspite of the higher organic material content of the marshy soil compared to the mineral soil the nitrogen content of both the soils were very similar, 4 and 3 micrograms of nitrogen per cu cm during day light, in the bottom layers of each soil, respectively. The nitrogen activity was found to decrease as the depth of the soils studied increased. Taking into consideration higher solubility in water a significant correlation was found between N1 and C1 in the marshy soil samples. Also in the soil layers between 50 to 80 cm the correlation with hydrogen ion concentration was also good. These results indicate that nitrogen removal was influenced by the groundwater in marshy soil layers. (Author's abstract)
W87-07797

EFFECT OF THE DEPTH OF ATMOSPHERIC PRESSURE AND GROUND WATER FREE LYSIMETER ON THE DRAINAGE WATER DISCHARGE AND EVAPORATION (EINFLUSS DER TIEFE GRUNDWASSERFREIER LYSIMETER OHNE UNTERDRUCK DUF SICKERWASSERABLAUF; UND VERDUNSTUNG),
Humboldt-Univ. zu Berlin (German D.R.). Sektion Pflanzenproduktion.
J. Katzur.
Archiv fuer Acker- und Planzenbau und Bodenkunde AAPBCE, Vol. 30, No. 4, p 227-233, 1986. 3 fig, 2 tab, 7 ref.

Descriptors: *Measuring instruments, *Groundwater, *Lysimeters, *Drainage water, *Evaporation, Atmospheric pressure, Flow, Irrigation.

A lysimeter without any groundwater and partial vacuum and capable of self sustaining drainage water flow in a rust colored sandy soil can affect the flow and evaporation rate of irrigation water. Measurements indicate that the depth (100, 200 and 300 cm) of operation of lysimeters affects the amount of discharge water and evaporation. At times very deep lysimeters discharge small quantities of water with corresponding high evaporation loss. (Author's abstract)
W87-07799

GROUNDWATER DISCHARGE FROM GLACIAL AND BEDROCK AQUIFERS AS A SOIL SALINIZATION FACTOR IN SASKATCHEWAN,
Saskatchewan Univ., Saskatoon. Saskatchewan Inst. of Pedology.
For primary bibliographic entry see Field 2F.
W87-07905

SOIL AND SUBSOIL MOISTURE ACCUMULATION DUE TO DRYLAND AGRICULTURE IN SOUTHERN ALBERTA,
Department of the Environment, Lethbridge (Alberta). Earth Sciences Div.
H. W. Christie, D. N. Graveland, and C. J. Palmer.
Canadian Journal of Soil Science CJSSAR, Vol. 65, No. 4, p 805-810, November 1985. 2 fig, 2 tab, 8 ref.

Descriptors: *Soil water, *Subsoil, *Alberta, *Agriculture, *Accumulation, *Cultivation, *Salinity, *Prairies, Hardpan soils, Crop production, Cultivated lands, Salts, Soil types, Fallowing.

Subsoil moisture accumulation due to cultivation and particularly summerfallowing is considered as an important causative agent of dryland salinity. However, few studies have been conducted to quantify the magnitude of this accumulation. The amount of additional moisture that had accumulated under cultivated land as compared to adjacent native prairie was determined at two sites in southern Alberta. In comparison to noncultivated sites, a total of 74.0 cm of additional moisture was found under the cultivated area of a Dark Brown Chernozem and 36.2 cm under a Brown Chernozem to a depth of 6 m. Only relatively insignificant changes in salt content were found. The greater moisture accumulation in the Dark Brown soil could be attributed to a longer period of cultivation and a lower moisture deficit. There was no evidence of salt accumulation below 2 m. It is concluded that soil water may continue to accumulate under present prairie dryland agricultural practices, possibly resulting in dryland salinity in areas not presently affected. (Author's abstract)
W87-07906

PITFALLS IN INTERPRETATION OF SOIL DRAINAGE FROM SOIL SURVEY INFORMATION,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
J. A. McKeague, and G. C. Topp.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 1, p 37-44, January-February 1986. 1 fig, 3 tab, 27 ref.

Descriptors: *Soil drainage, *Soil surveys, *Data interpretation, *Permeability coefficient, *Ontario, *Soil porosity, *Soil water *Soil classification, Drainage, Surveys, Soil types, Soil texture, Soil physical properties, Soil properties, Soil science, Classification, Soil structure, Porosity, Land use, Tile drainage.

Soil drainage groups assigned on the basis of soil survey information were evaluated against measured saturated hydraulic conductivity (Ksat) data for nine soils in Ontario. The drainage groups used in the drainage guide for Ontario are based mainly on assumed relationships between soil texture and the capacity of the soil to transmit water. Measured Ksat values were incompatible with the drainage groups assigned to at least four of the nine soils. For the soils tested, there was very little relationship between texture and Ksat. Structure, including porosity, had a major influence on Ksat, and near-surface structure is influenced greatly by land use. It is concluded that general interpretations of the drainage characteristics of soil series have serious limitations. The usefulness of soil survey information for interpretation of soil drainage could be increased by improved description of soil morphology and by reliable estimates of Ksat during mapping. Such estimates can be based on morphology if they are regularly recalibrated by measurement. (Author's abstract)
W87-07907

EFFECT OF SOIL WATER AND TEMPERATURE ON CORN (ZEA MAYS L.) ROOT GROWTH DURING EMERGENCE,
Manitoba Univ., Winnipeg. Dept. of Soil Science.
H. W. Cutforth, C. F. Shaykewich, and C. M. Cho.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 1, p 51-58, January-February 1986. 5 fig, 2 tab, 5 ref.

Descriptors: *Soil water, *Soil temperature, *Root development, *Corn, *Water stress, *Growth rates, Temperature, Roots, Germination, Agronomy, Crop production, Soil physical properties, Stress.

Root growth between germination and emergence was studied in the corn hybrids Pioneer 3995, Northrup King 403, and Pride 1108 at soil temperatures of 15, 19, 25, and 30.5 C and a range of soil water contents. Decreases in soil temperature and water content both decreased root growth rate. Roots were also noticeably thinner as temperature increased. Roots grown at 15 C were thicker, less branched, and had fewer root hairs than those grown at higher temperatures. Sensitivity to water content decreased with decreasing soil temperature. A linear regression of maximum root growth rate on temperature indicated that hybrids did not differ in their response of root growth rate to temperature. However, Pioneer 3995 was less sensitive to soil water stress than was Northrup King 403, while Pride 1108 was the most sensitive. (Author's abstract)
W87-07908

COMPARISON OF METHODS FOR DETERMINING SATURATED HYDRAULIC CONDUCTIVITY AND DRAINABLE POROSITY OF TWO SOUTHERN ALBERTA SOILS,
Department of Agriculture, Lethbridge (Alberta). Drainage Branch.
G. D. Buckland, D. B. Harker, and T. G. Sommerfeldt.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 2, p 249-259, May 1986. 1 fig, 5 tab, 30 ref.

Descriptors: *Saturation, *Permeability coefficient, *Measuring instruments, *Hydraulic conductivity, *Soil water, *Porosity, *Subsurface drainage, *Alberta, *Soil types, *Drainage systems, Drainage, Saturated soils, Performance evaluation, Permeameters, Drains, Subsurface drains, Water level fluctuations, Water table fluctuations, Profiles, Soil profiles, Cores.

Saturated hydraulic conductivity (K sub s) and drainable porosity (f) determined by different methods and for different depths were compared with those determined from the performance of drainage systems installed at two locations in order to determine which methods are suitable for use in subsurface drainage design. Values of auger hole and constant-head well permeameter K sub s were 140 and 110%, respectively, of those determined from subsurface drains. Agreement of horizontal or vertical K sub s from in situ falling-head permeameters to other methods was satisfactory providing sample numbers were large. K sub s by Tempe cells was only 3-10% of drain K sub s and in one instance was significantly lower than K sub s determined by all other methods. At one site, a profile-averaged value of f determined from the soil moisture characteristic curve (0-5 kPa) of semi-disturbed cores agreed with that determined from drainage trials. At the other site, a satisfactory value of f was found only when the zone in which the water table fluctuated was considered. Results indicate that K sub s determined by the auger hole and constant-head well permeameter methods, and f determined from the soil moisture characteristic curve of semi-disturbed cores, are sufficiently reliable and practical for subsurface drainage design. (Author's abstract)
W87-07910

RAPID METHOD FOR ESTIMATING WEIGHTED SOIL SALINITY FROM APPARENT SOIL ELECTRICAL CONDUCTIVITY MEASURED WITH AN ABOVEGROUND ELECTROMAGNETIC INDUCTION METER,
Missouri Univ.-Columbia. Dept. of Agronomy.
N. C. Wollenhaupt, J. L. Richardson, J. E. Foss, and E. C. Doll.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 2, p 315-321, May 1986. 4 fig, 3 tab, 12 ref.

Descriptors: *Geophysics, *Electrical studies, *Measuring instruments, *Estimating, *Saline soils, *Conductivity, *Calibrations, *Soil surveys, Soil chemical properties, Mapping, Regression analysis, Surveys.

A method is presented for calibrating electromagnetic induction instrument readings with saturated paste electrical conductivity (ECe) for field mapping purposes. Each meter reading represents an integration of the apparent soil electrical conductivity (ECa) over the meter's response depth. To correlate the meter readings with measured ECe within soil depth increments, several pedons representing a range of soil salinity for the survey area were sampled in 30-cm increments to a depth corresponding to the meter response. A weighting procedure based on the meter response-depth function was developed to condense the multiple ECe

by depth measurements into a single weighted area specific value. These values were correlated with the apparent soil electric conductivity from the electromagnetic induction instrument by simple linear regression. This technique is designed for soil association of similar parent materials. The resulting regression equation yields a quick reliable equation that avoids complex mathematics and converts the instrument readings into weighted forms of commonly used saturated paste electrical conductivity values. (Author's abstract)
W87-07912

AMELIORATION OF A CALCAREOUS SOLONETZIC SOIL BY IRRIGATION, DEEP RIPPING, AND ACIDIFICATION WITH ELEMENTAL SULFUR,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. B. Bole.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 2, p 347-356, May 1986. 2 fig, 4 tab, 20 ref.

Descriptors: *Soil amendments, *Cultivation, *Calcareous soils, *Infiltration, *Soil chemical properties, *Irrigation, *Acidification, *Sulfur, Soil types, Agronomy, Leaching, Oxidation, Biological oxidation, Bacteria, Crop yield, Sodium, Calcium, Magnesium, Solute transport, Permeability coefficient, Solubility, Lime, Barley.

The effect of leaching, deep ripping, and acidification by bacterial oxidation of elemental sulfur on the amelioration of a calcareous Solonetzic soil was investigated by measuring changes in soil chemical properties, infiltration, and crop yields over four seasons. Weekly applications of 12-25 mm of irrigation water for 9 wk in 1981 and 11 wk in 1982 leached over half of the soluble salts from the surface 60 cm of a Solonetzic soil. Sodium was more readily leached than Ca + Mg so that the sodium adsorption ratio (SAR) was reduced from more than 20 to less than 10 throughout the surface 60 cm. Further amelioration resulted from normal irrigation practices consisting of three 4-h applications of 50-60 mm of water in 1983 and 1984. Ripping with a subsoiler to a depth of 50-60 cm did not significantly affect the reclamation, although the surface infiltration rate and hydraulic conductivity remained higher 3.5 yr after tillage compared with the control. Oxidation of elemental S (3.3 t/ha) applied in 1981 resulted in a decrease in pH of the surface 15 cm of soil from 7.2 to 5.3 after two irrigation seasons. Naturally-occurring lime was dissolved by the S treatment, increasing the soluble Ca + Mg and total salts and decreasing the SAR. These effects were no longer evident after the 1984 irrigation season. Yields of spring barley (Hordeum vulgare) were not affected by the tillage or S treatments. (Author's abstract)
W87-07913

EFFECT OF SOIL MOISTURE AND PH ON THE RESPONSE OF ALFALFA TO MOLYBDENUM (EFFETS DES REGIMES HYDRIQUES ET DES PH DU SOL SUR LA REPONSE AU MOLYBDENE DE LA LUZERNE),
Department of Agriculture, Lennoxville (Quebec). Station de Recherches.
J. L. Dionne, and A. R. Pesant.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 3, p 421-435, August 1986. 4 fig, 7 tab, 25 ref.

Descriptors: *Soil water, *Hydrogen ion concentration, *Molybdenum, *Alfalfa, *Soil amendments, *Agronomy, Heavy metals, Soil types, Lime, Acidity, Fertilizers, Saturation, Crop yield, Bioaccumulation, Accumulation.

Alfalfa was grown on three different soils at different pH levels (5.0, 6.5, and 7.5), molybdenum application rates (0.0, 0.1, 0.2, and 0.3 mg Mo per kg of soil), and moisture levels (dry, optimal, and saturated). Yields were not affected by molybdenum applications regardless of soil type, soil pH, or soil moisture regimes. Mo content of alfalfa increased linearly with rates of Mo from 0.2 ppm to 23 ppm Mo. Liming soil to pH 7.2 produced the same increase of Mo content in alfalfa as applying Mo at the rate of 0.2 mg/kg to acid soils. Mo content of alfalfa was also slightly increased by soil moisture. A Mo content of 20 ppm or more was obtained as a result of the combined effect of molybdenum application, liming, and soil moisture regimes. The exchangeable Mo content found in soils after the experiment increased with rate of Mo but decreased with increasing soil pH. The uptake of molybdenum was increased so much by liming that the Mo left in soil after cropping was decreased as soil pH increased. (Author's abstract)
W87-07914

EFFECT OF SUBSOILING ON WHEAT YIELD AND SALT DISTRIBUTION OF A SOLONETZIC SOIL,
Department of Agriculture, Lethbridge (Alberta). Research Station.
C. Chang, T. G. Sommerfeldt, G. B. Schaalje, and C. J. Palmer.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 3, p 437-443, August 1986. 2 fig, 4 tab, 17 ref.

Descriptors: *Cultivation, *Crop yield, *Wheat, *Salt, *Distribution, *Soil types, *Solute transport, *Irrigation effects, Irrigation, Spatial distribution, Soil physical properties, Soil chemical properties, Soil chemistry, Salinity, Saline soils, Alberta, Fertilizers, Nitrogen, Phosphates, Profiles, Soil profiles.

The effects of subsoiling (deep ripping to 52 cm depth) in the amelioration of a Solonetzic soil under irrigated and nonirrigated conditions were examined at experimental plots in Alberta. All plots were fertilized by broadcasting N and P2O5 at rates of 80 and 42 kg/ha, respectively. Hard spring wheat was grown annually from 1980 to 1984. The plot area had a high degree of spatial variability in both physical and chemical properties of the soil. Subsoiling in the fall of 1979 and 1980 had no significant effects on soil salinity and sodicity or on wheat yield under nonirrigated conditions. However, under irrigated conditions, subsoiling enhanced the downward movement of salts and had a significant overall profile (to 90 cm) effect on soil salinity and sodicity, but it had no significant effect among depths within the profile. Subsoiling also had no significant effect on wheat yield under irrigated conditions. Irrigation alone improved the soil salinity and sodicity conditions, increased wheat yields, and reduced yield variability. (Author's abstract)
W87-07915

INFLUENCE OF DRAIN DEPTH ON THE RATE OF SOIL RECLAMATION IN IRRIGATED AREAS OF SOUTHERN ALBERTA,
Department of Agriculture, Lethbridge (Alberta). Drainage Branch.
For primary bibliographic entry see Field 4A.
W87-07917

COMPACTION AND TILLAGE DEPTH COMBINATIONS FOR WATER MANAGEMENT AND RICE PRODUCTION IN LOW-RETENTIVE PERMEABLE SOILS,
Indian Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W87-07921

EFFECTS OF TILLAGE METHODS AND WATER REGIMES ON SOIL PROPERTIES AND YIELD OF LOWLAND RICE FROM A SANDY LOAM SOIL IN SOUTHWEST NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 3F.
W87-07922

VARIABILITY OF INFILTRATION UNDER UNCERTAINTY IN UNSATURATED ZONE PARAMETERS,
Butler Univ., Indianapolis, IN. Holcomb Research Inst.
A. I. El-Kadi.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 61-80, March 1987. 9 fig, 4 tab, 33 ref.

Descriptors: *Correlation analysis, *Model studies, *Cross-correlation analysis, *Unsaturated zone, *Infiltration, *Mathematical equations, *Monte Carlo method, Soil water, Hydraulic conductivity, Permeability coefficient, Ponding, Stochastic process, Rainfall.

A problem of special interest is the variability of modeled infiltration caused by uncertainty in unsaturated zone parameters. The problem is studied here by solving a one-dimensional form of Richards' equation within a Monte Carlo analysis. Based on experimental data, cross-correlation between measurable soil properties - namely, the soil-water characteristic function and the hydraulic conductivity function - is defined. The unsaturated zone parameters can be estimated explicitly from the value of the saturated hydraulic conductivity. Also clarified are the effects of spatially varied parameters on the variability of point infiltration, water content, and time to the onset of ponding. The paper explores how both model sophistication and parameter cross-correlation affect modeling results. Analytical solutions can be used in the stochastic analysis if cross-correlation is considered. The inclusion of cross-correlation decreases the variability of output parameters without much effect on the mean values of these parameters. An effective value is defined for the saturated hydraulic conductivity that may characterize the heterogeneous soil. For a specified rainfall intensity, this value depends on the variability and autocorrelation structure of the saturated hydraulic conductivity. Neglecting variability may lead to unacceptable errors. (Author's abstract)
W87-08121

SOLUTE TRANSPORT WITH EQUILIBRIUM AQUEOUS COMPLEXATION AND EITHER SORPTION OR ION EXCHANGE: SIMULATION METHODOLOGY AND APPLICATIONS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W87-08122

SPATIAL VARIABILITY OF INFILTRATION IN A SEMI-ARID ENVIRONMENT,
Lund Univ. (Sweden). Dept. of Water Resources Engineering.
R. Berndtsson, and M. Larson.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 117-133, March 1987. 8 fig, 2 tab, 29 ref.

Descriptors: *Spatial variability, *Infiltration, *Semi-arid lands, *Infiltrometers, Urban areas, Catchments, Tunisia, Geomorphology, Vegetation patterns, Wadis, Statistics.

Fifty-two double-ring infiltrometer tests, performed in a small, partly urbanized catchment in northern Tunisia are analyzed. Spatial variability is characterized by use of cross-correlation functions. Spatial patterns of infiltration properties are shown to be governed by geomorphology and occurring vegetation. Different geomorphological zones and zones with equal density of vegetation tend to be oriented in a parallel pattern in relation to the wadi. Statistical properties of infiltration capacities depending on geomorphological zone are presented. (Author's abstract)
W87-08123

RETENTIVITY FUNCTION FOR USE IN SOIL - WATER SIMULATION MODELS,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
J. L. Hutson, and A. Cass.
Journal of Soil Science JSSCAH, Vol. 38, No. 1, p 105-113, March 1987. 6 fig, 3 tab, 13 ref.

Descriptors: *Model studies, *Flow simulation models, *Retentivity functions, *Model studies, *Simulation analysis, *Soil water movement, *Soil water, *Porosity, Soil properties, Regression analysis, Density, Soil profiles, Hydrology, Soil types.

A sigmoidal, non-hysteretic two-part retentivity function having only two constants in addition to

porosity was developed for use in soil-water flow simulation models. Values of the constants, shapes of the retentivity curves, and soil textural properties were related by fitting the retentivity function to retentivity data generated using regression equations. Two sets of regression equations, which relate water content at specific matric potentials to soil texture and bulk density, were used, one for British soils and one for South African soils. Hydrologically inhomogenous soils may be modelled by varying the values of the retentivity constants through the profile to reflect changing soil properties. (Author's abstract)
W87-08130

CORRELATIONS OF COMPOUND PROPERTIES WITH SORPTION CHARACTERISTICS OF NONPOLAR COMPOUNDS BY SOILS AND SEDIMENTS: CONCEPTS AND LIMITATIONS,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W87-08178

SIMULATION OF WATER FLOW IN THE UNSATURATED ZONE INCLUDING THE ROOT ZONE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
K. H. Jensen.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-751000. Price codes: A11 in paper copy, A01 in microfiche. Report No. DTH-ISVA--33, May 1983. 259 p, 106 fig, 12 tab, 108 ref, 2 append.

Descriptors: *Soil water, *Groundwater movement, *Root zone, *Simulation analysis, *Denmark, *Model studies, Flow profiles, Finite difference methods, Mathematical equations, Hydrologic models, Mathematical models.

A one-dimensional soil water flow model has been developed based on a finite difference approximation of the governing differential equation. In the flow equation is included a sink term representing the moisture extraction by root systems, and allowance for evaporation from the soil surface is made too. Estimation of these terms is based on a potential transpiration calculated from the Penman-Monteith equation, on a potential soil evaporation calculated from the Ritchie equation and in both cases on relations to soil moisture availability over various soil depths. In addition, an interception description is included. The performance of the model is tested against extensive data collected from field studies of agricultural crops at two locations in Denmark, which represent two different soil conditions. Measured and simulated soil water contents and soil water pressure heads compare well. The physical basis of the model provides a potential for a wide range of applications and allows for a prediction of the effect of human activities. In this respect, the model has been applied for predicting the consequences of irrigation on the hydrologic subprocesses of evapotranspiration and deep percolation. This prediction has been validated against measurements. The soil water flow model may be included in a distributed and physically based hydrologic catchment model to link the processes of overland and channel flow and groundwater flow. Since the model describes the variation of water flow and moisture content throughout the profile, it provides the necessary input for the calculation of the transport and dispersion of solutes in the soil profile. (Author's abstract)
W87-08214

PHENOTYPIC FLEXIBILITY OF CAREX FLACCA SCHREB.: TOLERANCE OF SOIL FLOODING BY POPULATIONS FROM CONTRASTING HABITATS,
University Coll., Cork (Ireland). Dept. of Plant Science.
For primary bibliographic entry see Field 2I.
W87-08326

MULTIGRID MODEL FOR STEADY FLOW IN PARTIALLY SATURATED POROUS MEDIA,
Washington Univ., Seattle. Dept. of Civil Engineering.
T. J. McKeon, and W.-S. Chu.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 542-550, April 1987. 11 fig, 4 tab, 40 ref. Washington Water Research Center Project A-138-WASH.

Descriptors: *Soil water movement, *Groundwater movement, *Model studies, *Steady flow, *Porous media, *Saturation, Algorithms, Equations, Computers, Performance evaluation, Simulation, Soil properties.

A numerical model for steady flow in a partially saturated porous medium is presented. The model uses the multigrid solution algorithm for solving the system of equations resulting from the discrete approximation to the partial differential equation. The model solutions checked favorably with an existing analytical solution. Used for a hypothetical problem with realistic soil characteristics the model has been shown to be very efficient for problems with the number of unknowns on the order of 10,000 and more. Specifically, the multigrid scheme was shown to be 22 times faster in terms of CPU time than the line successive overrelaxation method for the particular problem chosen. In addition, the required CPU time is shown to be a linear function of the number of unknowns within the solution domain. This indicates that the convergence rate of the multigrid solution algorithm is independent of the grid resolution. Because of the significant improvement in computational efficiency, the multigrid model can be used to simulate field scale partially saturated flow problems with very fine grid resolution as is often required by highly nonlinear soil characteristics. Further studies and application of the multigrid solution technique are suggested. (Author's abstract)
W87-08330

BOUNDARY ELEMENT - FINITE ELEMENT PROCEDURE FOR POROUS AND FRACTURED MEDIA FLOW,
Pennsylvania State Univ., University Park. Dept. of Mineral Engineering.
For primary bibliographic entry see Field 2F.
W87-08331

DEPTH-AVERAGING EFFECTS ON HYDRAULIC HEAD FOR MEDIA WITH STOCHASTIC HYDRAULIC CONDUCTIVITY,
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2F.
W87-08332

SOIL WATER SATURATION: DIELECTRIC DETERMINATION,
Oklahoma State Univ., Stillwater. Dept. of Physics.
For primary bibliographic entry see Field 7B.
W87-08335

PARAMETRIC MODEL FOR CONSTITUTIVE PROPERTIES GOVERNING MULTIPHASE FLOW IN POROUS MEDIA,
J. C. Parker, R. J. Lenhard, and T. Kuppusamy.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 618-624, April 1987. 4 fig, 1 tab, 25 ref. EPA Assistance agreement CR-812073.

Descriptors: *Soil water movement, *Groundwater movement, *Flow models, *Model studies, *Porous media, *Multiphase flow, *Saturation, Calibrations, Permeability, Flow, Estimating.

A parametric model is developed to describe relative permeability-saturation-fluid pressure functional relationships in two- or three-fluid phase porous media systems subject to monotonic saturations paths. All functions are obtained as simple closed-form expressions convenient for implementation in numerical multiphase flow models. Model calibration requires only relatively simple determinations of saturation-pressure relations in two-phase systems. A scaling procedure is employed to simplify the description of two-phase saturation-capillary head relations for arbitrary fluid pairs and experimental results for two porous media are presented to demonstrate its applicability. Extension of two-phase relations to three-phase systems is obtained under the assumption that fluid wettability follows the sequence water > nonaqueous phase liquid > air. Expressions for fluid relative permeabilities are derived from the scaled saturation-capillary head function using a flow channel distribution model to estimate effective mean fluid-conducting pore dimensions. Constraints on model application are discussed. (See also W87-08339) (Author's abstract)
W87-08338

FINITE-ELEMENT ANALYSIS OF MULTIPHASE IMMISCIBLE FLOW THROUGH SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
T. Kuppusamy, J. Sheng, J. C. Parker, and R. J. Lenhard.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 625-631, April 1987. 9 fig, 2 tab, 15 ref. EPA Assistance agreement CR-812073.

Descriptors: *Soil water movement, *Model studies, *Finite element analysis, *Multiphase flow, *Porous media, Conductivity, Saturation, Calibrations, Simulation, Prediction, Groundwater.

A finite-element model is developed for multiphase flow through soil involving three immiscible fluids: namely, air, water, and a nonaqueous phase liquid (NAPL). A variational method is employed for the finite-element formulation corresponding to the coupled differential equations governing flow in a three-fluid phase porous medium system with constant air phase pressure. Constitutive relationships for fluid conductivities and saturations as functions of fluid pressures, which are derived in a companion paper by and which may be calibrated from two-phase laboratory measurements, are employed in the finite-element program. The solution procedure uses backward time integration with iteration by a modified Picard method to handle the nonlinear properties. Laboratory experiments involving water displacement from soil columns by p cymene (a benzene-derivative hydrocarbon) under constant pressure were simulated by the finite-element program to validate the numerical model and formulation for constitutive properties. Transient water outflow predicted using independently measured saturation-capillary head data agreed with observed outflow data within the limits of precision of the predictions as estimated by a first-order Taylor series approximation considering parameter uncertainty due to experimental reproducibility and constitutive model accuracy. Two-dimensional simulations are presented for a hypothetical field case involving introduction of NAPL near the soil surface due to leakage from an underground storage tank. Subsequent transport of NAPL in the variably saturated vadose and groundwater zones is analyzed. (See also W87-08338) (Author's abstract)
W87-08339

SOLUBILITY OF 2,3,7,8-TCDD IN CONTAMINATED SOILS,
Battelle Columbus Div., OH.
For primary bibliographic entry see Field 5B.
W87-08475

IDENTIFICATION OF RECENT CALCITE PRECIPITATION IN SOIL WITH THE HELP OF ISOTOPE INVESTIGATIONS (NACHWEIS VON CARBONATAUSFAELLUNGEN IM BODEN MIT HILFE VON ISOTOPENUNTERSUCHUNGEN),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
J. Hoppe, B. Merkel, L. Eichinger, and M. Hofmann.
Zeitschrift fuer Wasser- und Abwasser Forschung ZWABAQ, Vol. 20, No. 1, p 16-21, February 1987. 7 fig, 6 tab, 12 ref, append.

Descriptors: *Model studies, *Soil chemistry, *Carbonates, *Precipitation, *Isotopic tracers, *Calcite, Seepage, Computer models, Thermodynamics, Soil gases, Soil water, Carbon dioxide.

Due to increasing CO2 partial pressure in soil gas during summer an increasing amount of calcite is dissolved in seepage water in the upper soil area. Consequent to lower partial pressure in deeper soil layers calcite precipitation can occur. Recent calcite precipitation could be demonstrated in the entire calcite environment with the help of isotopes. Further information results from thermodynamic model calculations, which were performed for seepage water withdrawn from different depths. (Author's abstract)
W87-08528

GENERALIZED MEIN-LARSON INFILTRATION MODEL,
South Dakota State Univ., Brookings. Dept. of Agricultural Engineering.
S.-T. Chu.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 155-162, May 1987. 3 fig, 1 tab, 10 ref.

Descriptors: *Soil water movement, *Model studies, *Infiltration models, *Rainfall, *Infiltration, *Numerical analysis, *Runoff, Comparison studies, Performance evaluation, Vegetation, Irrigation.

The Mein-larson extension of the Green-Ampt infiltration model is extended further to analyze the infiltration process under a variable rain on a covered natural soil. Such a condition represents the infiltration under center pivot irrigation when the vegetation cover is developed. A graphical procedure is developed to handle the calculations. A numerical example is used to illustrate the application of the model to determine potential runoff. The performance of the model is demonstrated by two numerical examples presented by Heermann and Duke (1983) and is compared with the performances of two existing models. (Author's abstract)
W87-08580

PREDICTING UNSATURATED HYDRAULIC CONDUCTIVITY FROM SOIL TEXTURE,
Integrated Systems, Inc., San Jose, CA.
L. Alexander, and R. W. Skaggs.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 184-197, May 1987. 8 fig, 6 tab, 28 ref.

Descriptors: *Unsaturated flow, *Soil texture, *Permeability coefficient, *Hydraulic conductivity, *Prediction, *Saturation, Statistical analysis, Estimating, Comparison studies, Performance evaluation, Equations.

A total of 14 methods to predict K(h) from soil texture and/or other data were tested. Nine of the methods involved first predicting theta(h) from texture and/or other data, then using a method to predict K(h) from theta(h). Using each of these methods, K(h) relationships of several soils were predicted. Some of the methods required matching the predicted K(h) to the measured K(h) at saturation. The predicted K(h) was compared statistically and graphically to measured K(h) data, which is given in the literature for these soils. Results showed that for the methods that did not match the predicted K(h) to the measured K(h) at saturation, a method by McCuen, et al., provided the best estimate of the measured K(h). Additionally, matching the K(h) at saturation improved the performance of the McCuen, et al., method. The resulting method provided the best estimate of the measured K(h) of all the methods tested for the loamy and clayey soils. For the sandy soils, substitution of Ghosh's closed-form equation for theta(h) into the Burdine equation for K resulted in the best approximation of K(h) of all the methods tested. (Author's abstract)
W87-08583

SEEPAGE INTO VARIABLY SATURATED POROUS MEDIUM,
California Univ., Davis. Dept. of Land, Air and Water Resources.
J. C. Tracy, and M. A. Marino.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 198-212, May 1987. 6 fig, 1 tab, 21 ref. ARS Cooperative agreement 4350-H.

Descriptors: *Infiltration, *Surface-groundwater relations, *Soil water movement, *Unsaturated flow, *Aquifers, *Model studies, *Seepage, *Porous media, *Saturation, *Simulation, Path of pollutants, Surface water, Boundary conditions, Subsurface flow, Equations.

A numerical model is developed for simulating the interaction of a surface water body with a variably saturated porous medium. A boundary condition simulating the soil-water pressure head at the boundary between the porous medium and the surface water body, expressed as a function of the soil-water flux at the boundary, is also integrated into the model. The interaction of the surface and subsurface flow system leads to a more accurate simulation of soil-water flow velocity, which is of importance in problems dealing with the seepage of pollutants into the subsurface environment. The Galerkin-finite element method is used to solve the variably saturated flow equation and the Darcy equation, employing isoparametric elements that simulate the physical geometry of the porous medium. Solutions to the model give the transient position of the stage of the surface water body and the distribution of the phreatic surface in the porous medium, providing robust estimates of the rate of seepage into the porous medium. The capability of the model is illustrated by considering the interaction of a semipervious surface pond with a variably saturated stream-aquifer system. (Author's abstract)
W87-08584

DRAINAGE OF SLOPING LANDS WITH CONSTANT REPLENISHMENT,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Irrigation and Drainage Engineering.
S. Ram, and H. S. Chauhan.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 213-223, May 1987. 6 fig, 1 tab, 17 ref.

Descriptors: *Recharge, *Infiltration, *Surface-groundwater relations, *Model studies, *Drainage, *Numerical analysis, *Aquifers, *Water table, *Replenishment, Mathematical equations, Slopes.

An analytical solution is derived using the Boussinesq equation to describe an unsteady rising water-table profile in an aquifer lying over a mildly sloping impervious bed in response to constant replenishment. A Hele-Shaw model is used for experimental verification of the analytical solution. Reasonably close agreement is found in the computed and observed phreatic surfaces. The analytical solution can be used with reasonable accuracy for the design of subsurface drainage in sloping phreatic aquifers. (Author's abstract)
W87-08585

MODELING SATURATED-UNSATURATED WATER FLOW IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
S.-O. Chung, and T. A. Austin.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 233-250, May 1987. 7 fig, 4 tab, 29 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Groundwater movement, *Model studies, *Saturated flow, *Saturation zone, *Stochastic process, *Soil water, Hysteresis, Monte Carlo method, Hydraulic conductivity, Simulation, Prediction, Water table.

A model for the transient one-dimensional water movement in the saturated-unsaturated zone using a finite difference method with stochastic inputs is developed. Hysteresis in the soil water retention and hydraulic conductivity-versus-moisture content relationship is incorporated. The model considers layered geologic formations with each layer having different parameters. Monte Carlo simulation, together with the nearest neighbor model, is used to incorporate the stochastic nature of hydraulic conductivity into the flow model. Outputs of the flow model include pressure head, water content, and the water-table elevation. Two Monte Carlo simulations of 100 realizations each are made for a 12-day simulation period. Input standard deviations of the log saturated hydraulic conductivity are assumed to be 20% and 40% of the mean of log saturated conductivity for the two Monte Carlo runs, respectively. The standard deviations of the water-table elevation and pressure head increase with an increase in the standard deviation of log saturated hydraulic conductivity. The model is applied to predict a long-term water-table fluctuation, and the predicted water table agrees well with the observed one. (Author's abstract)
W87-08587

1-D, 2-D, AND 3-D INFILTRATION FOR IRRIGATION,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3F.
W87-08589

2H. Lakes

GROWTH PATTERN AND YIELD OF A CHEMOAUTOTROPHIC BEGGIATOA SP. IN OXYGEN - SULFIDE MICROGRADIENTS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
D. C. Nelson, B. B. Jorgensen, and N. P. Revsbech.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 225-233, August 1986. 5 fig, 3 tab, 33 ref. Danish NSR Council Grant 11-4143 and NSF Grant PCM-8314358.

Descriptors: *Beggiatoa, *Growth kinetics, *Yield, *Bacterial physiology, *Oxygen, *Sulfides, *Vertical distribution, *Sulfur bacterial, *Culturing techniques, Distribution, Hydrogen, Hydrogen ion concentration, Hydrogen sulfide, Oxidation, Biologiccal oxidation, Chemical reactions, Bacteria, Microbiological studies, Anaerobic conditions, Diffusion coefficient, Sulfur cycle.

Recently developed techniques involving opposed, gel-stabilized gradients of 02 and H2S permit cultivation of a marine Beggiatoa strain as a chemolithoautotroph which uses gliding motility to precisely track the interface between H2S and O2. Using microelectrodes, vertical profiles of H2, O2, and pH were measured in replicate cultures grown for various intervals. By measuring the extent to which the presence of the bacterial plate diminished the overlap of O2 and H2S, it was demonstrated that oxidation of H2S by Beggiatoa sp. is approximately three orders of magnitude faster than spontaneous chemical oxidation. By integrating sulfide profiles and comparing sulfide consumed with biomass produced, a growth yield of 8.4 g (dry weight)/mol of H2S was computed, indicating very efficient growth of Beggiatoa sp. as a chemoautotroph. It is concluded that these methods offer a unique opportunity to determine the yield of H2S-oxidizing chemolithoautotrophs while avoiding several problems inherent in the use of homogeneous liquid culture. Finally, by monitoring time dependent formation of H2S profiles under anoxic conditions, a method for calculating the molecular diffusion coefficient of soluble substrates in gel-stabilized media was demonstrated. (Author's abstract)
W87-07595

MICROBIAL RELEASE OF 226RA(2+) FROM (BA,RA)SO4 SLUDGES FROM URANIUM MINE WASTES,
Alberta Univ., Edmonton. Dept. of Chemistry.
For primary bibliographic entry see Field 5E.
W87-07596

AEROBIC METABOLISM OF TRICHLOROETHYLENE BY A BACTERIAL ISOLATE,

Technology Applications, Inc., Gulf Breeze, FL.
M. J. K. Nelson, S. O. Montgomery, E. J. O'Neill, and P. H. Pritchard.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 383-384, August 1986. 3 tab, 7 ref. EPA Interagency Agreement FY 8952-85-1008.

Descriptors: *Fate of pollutants, *Bacterial physiology, *Aerobic conditions, *Trichloroethylene, *Chlorinated hydrocarbons, *Biodegradation, Microbiological studies, Metabolism, Pollutants, Hydrocarbons, Organic compounds, Carbon dioxide, Degradation, Oxygen, Bacteria.

A number of soil and water samples from six sites in the Pensacola, FL area known to be contaminated with organochlorine compounds were screened for the biological capacity to metabolize trichloroethylene (TCE). One water sample, from the Naval Air Station, was found to contain this capacity; a gram-negative, rod-shaped bacterium which appeared to be responsible for this metabolic activity was isolated from this sample. The isolate, tentatively ascribed to the genus Acinetobacter, degraded TCE to CO2 and unidentified, nonvolatile products. Oxygen and water from the original site of isolation were required for degradation; it is suggested that an unknown factor in this water may act as an inducer for synthesis of the enzyme(s) responsible for TCE degradation. This is the first isolation of a pure culture capable of metabolizing TCE under aerobic conditions. (Author's abstract)
W87-07599

PHENOTYPIC AND GENOTYPIC ADAPTATION OF AEROBIC HETEROTROPHIC SEDIMENT BACTERIAL COMMUNITIES TO MERCURY STRESS,
California Univ., Irvine. Environmental Analysis Div.
For primary bibliographic entry see Field 5C.
W87-07602

EFFECT OF SMELTING OPERATIONS ON PEATLANDS NEAR SUDBURY, ONTARIO, CANADA,
Alberta Univ., Edmonton. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W87-07603

PREDICTION OF TEMPERATURES IN RIVERS USING A CONCEPTUAL MODEL (PREVISION DES TEMPERATURES DE L'EAU EN RIVIERE A L'AIDE D'UN MODELE CONCEPTUEL),
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
G. Morin, D. Couillard, D. Cluis, H. G. Jones, and J.-M. Gauthier.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 31-41, March 1987. 2 fig, 1 tab, 16 ref.

Descriptors: *Model studies, *Hydrological models, *Streamflow, *Water temperature, *Rivers, *Limnology, Simulation, Watersheds, Energy, Saint-Anne River.

The proposed water temperature model is part of a global water quality model which is based on a conceptual hydrological model. The hydrological model allows daily simulation of streamflow at any point within a watershed. For this purpose, the watershed is divided grid-wise into square elements on which are evaluated the physiographic characteristics and the meterological data required to calculate the water balance. The temperature model developed is applicable to the ice-free period and uses an energy budget. The energy budget considers thermal exchanges with the atmosphere, short wave solar radiation, long wave radiation, evaporation and convection in the air, and also advective heat from various inflows e.g. surface runoff, interflow and groundwater. The model has been applied to the Saint-Anne River (Quebec, Canada) for four different years. (Author's abstract)
W87-07613

PETERSEN'S BENTHIC STATIONS REVISITED. II. IS THE OSLOFJORD AND EASTERN SKAGERRAK ENRICHED,
Havsfiskelaboratoriet, Lysekil (Sweden).
For primary bibliographic entry see Field 2L.
W87-07630

CONTAMINANT EFFECTS ON FISHERIES.
Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch.
For primary bibliographic entry see Field 5C.
W87-07631

EPIDEMIOLOGY OF DISEASES IN WILD FISH POPULATIONS,
Idaho Univ., Moscow. Dept. of Fish and Wildlife Resources.
For primary bibliographic entry see Field 5C.
W87-07633

PHYSIOLOGICAL RESPONSES OF FISH: PROBLEMS AND PROGRESS TOWARD USE IN ENVIRONMENTAL MONITORING,
Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife.
G. R. Bouck.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 61-71, 2 tab, 18 ref.

Descriptors: *Fish physiology, *Bioindicators, *Stress, *Monitoring, *Water quality, Water pollution effects, Fish, Enzymes, Trout, Leucine amino naphthylamidase, Salinity, Nutrition, Toxicity.

The use of physiological responses of wild fish to assess environmental quality is seldom successful, in part because wild fish are usually stressed during collection. Capture stress precludes the use of sensitive, early indicators of environmental stress. An alternative strategy diminishes the effects of capture by the use of more slowly responding indicators, such as leakage of enzymes from cells into the blood. Studies were conducted on plasma and tissue leucine amino naphthylamidase activity (LAN) in rainbow trout. Biochemical studies validated the methodology and demonstrated the presence of LAN in all tissues except brain. LAN is apparently liberated from lysosomes of dead cells and passes indirectly into the blood as debris. Plasma LAN can be changed by environmental stress (salinity), nutritional stress (fasting), physiological stress (reproduction, fasting, and bleeding), and toxicant stress (borate). Therefore, LAN may be useful in assessing wild fish, provided they are sampled immediately upon capture. (See also W87-07631) (Lantz-PTT)
W87-07637

FISH SERUM CHEMISTRY AS A PATHOLOGY TOOL,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W87-07638

MONITORING LEAD EXPOSURE OF FISH,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W87-07639

METALLOTHIONEIN AND ACCLIMATION TO HEAVY METALS IN FISH: A REVIEW,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W87-07640

PATHOLOGICAL RESPONSES OF FERAL TELEOSTS TO ENVIRONMENTAL STRESSORS: INTERLAKE STUDIES OF THE PHYSIOLOGY OF GREAT LAKES SALMON,
Guelph Univ. (Ontario). Dept. of Zoology.
J. F. Leatherland, and R. A. Sonstegard.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 115-149, 13 tab, 213 ref.

Descriptors: *Stress, *Fish physiology, *Teleosts, *Reviews, *Monitoring, *Water pollution effects, *Great Lakes, Fish, Salmon, Case studies, Environmental effects.

There is obvious value in monitoring the effects of known stressors on the physiology of animal species. such studies provide a standard by which the severity and significance of other putative environmental stressors can be measured. One purpose of this review is to reexamine the concept of stress in teleost fish, particularly with respect to the way in which the stress response has been monitored in a variety of species and under various experimental conditions. In light of Hans Selye's concept of a 'generation adaptation syndrome' one might expect to find a common expression of the stress response in a variety of species. The stressor mediated increase in plasma cortisol might represent such a common denominator in teleosts. While this appears to be the case in certain situations, other physiological responses to stressors, particularly chronic stressors, might be indicators. In the second part of the review a 'case study' of a chronic environmental stressor situation, that of the oncorhynchid populations in the Great Lakes of North Americ, is examined. The considerable interlake differences in the physiology of these salmon suggest that the fish are adapting to a unique set of environmental factors (stressors) within a given lake. Since the fish are exposed to these environmental factors (stresors) for the major part of their life cycle, the stressor effect is generally multifactorial and chronic. For reasons discussed here, the 'primary' stress indicators (such as blood cortisol elevation) are inappropriate in this type of situation. The interlake physiological differences are considered with regard to their value as stress indicators. (See also W87-07631) (Lantz-PTT)
W87-07641

ADENYLATE ENERGY CHARGE AS A MEASURE OF STRESS IN FISH,
Georgia Univ., Athens. School of Forest Resources.
R. E. Reiner, and D. W. Hohreiter.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 151-161, 1 fig, 2 tab, 26 ref, Georgia Sea Grant Program Project R/EE-10.

Descriptors: *Adenylate energy charge, *Stress, *Fish physiology, *Bioassay, *Bioindicators, Toxicity, Monitoring, Aquatic environment, Fish, Tissue analysis, Bioassays, Dissolved oxygen, Water temperature, Hydrogen ion concentration, Heavy metals, Pesticides.

Information concerning Adenylate Energy Charge (AEC) in fish and other organisms suggests that changes in AEC can prove to be early and sensitive indicators of certain types of stress-induced metababolic changes. However, the value of this technique as a general measure of stress in the field depends on the number of stressors that affect the adenylate system. If AEC only responds to a few, it will only have limited application as a measure of the well-being of fish and other aquatic organisms in field situations. If, however, AEC is sensitive to a wide variety of stressors, it could be a very useful tool for determining stress in field situations. One phase of the AEC technique that needs further study is the method of dissecting samples. Although it is relatively easy to get homogenous tissue samples from a large fish, it is extremely difficult to dissect small fish quickly without having the muscle samples contaminated with small pieces of other tissue. An area of great potential for the use of AEC in the laboratory would be in chronic bioassay studies where the effects of known stressors such as contaminants are tested under conrolled conditions. However, to fully assess the applicability of AEC as a bioassay tool, it will be necessary to determine the sensitivity of the adenylate system in different species of fish and in different fish tissues to a variety of stressors. These should include water quality parameters such as DO concentration, temperature,

and pH and a variety of xenobiotics such as pesticides, industrial components, and heavy metals. Of special importance would be the relation of AEC values determined for fish over short exposure periods to long-term metabolic changes that affect the fish's growth, reproduction, behavior, and mortality. (See also W87-07631) (Lantz-PTT)
W87-07642

ASSESSING THE TOLERANCE OF FISH AND FISH POPULATIONS TO ENVIRONMENTAL STRESS: THE PROBLEMS AND METHODS OF MONITORING,
Seattle National Fishery Research Center, WA.
For primary bibliographic entry see Field 5C.
W87-07643

MEASURING THE HEALTH OF AQUATIC ECOSYSTEMS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
S. R. Kerr, and L. M. Dickie.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 279-284, 17 ref.

Descriptors: *Ecosystems, *Water pollution effects, *Monitoring, Sublethal effects, Toxicity, Aquatic animals, Ecological effects.

Environmental change, whatever its form, acts on individuals or their offspring. In the case of toxic contaminants, for example, effects on individuals can sometimes be immediate and very clear, resulting in death. But an enormous and growing literature attests, in addition, to ubiquitous sublethal effects, varying from behavioral modification through physiological impairment to morphological deformation. There are proven cases of effects on fecundity, fertility, and zygote viability. In short, a virtual plethora of information reflects direct deleterious effects, of varying subtlety, on the health of individual organisms and sometimes on their progeny. In the face of welter of disparate effects, the question naturally arises as to the possibility of assessing, in integral form, the varied responses of individual organisms to environmental insult. A positive answer to the question depends upon the reality of existence of community-level regularities. Evidence for conservative patterns of ecological structure and function is required. In fact, there is ample evidence that such regularities indeed exist, providing evidence of control at the community level of organization. Given evidence of the existence of ecological control, contemporary systems theory justifies the goal of seeking ways to describe how environmental contaminants may disrupt ecological control systems, and consequently, modify the normal patterns of community structure and function. Accordingly, the feasibility of assessing ecological health at the community level of biological organization is dealt with here. In particular, the emphasis is to demonstrate that a theoretical basis exists to support the possibility of deriving useful indices of community health, and that there is both theoretical and empirical support of the choice of criterion that is identified here. (See also W87-07631) (Lantz-PTT)
W87-07649

BOTANICAL RECONNAISSANCE OF SILVER LAKE RESEARCH NATURAL AREA, NORTH CASCADES NATIONAL PARK, WASHINGTON,
Pacific Northwest Forest and Range Experiment Station, Portland, OR.
R. Lesher.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as PB84-233063. Price codes A01 in microfiche, A02 in paper copy. Research Note PNW410, April 1984. 27 p. 1 fig, 2 tab, 14 ref.

Descriptors: *Botany, *Limnology, *Silver Lake, *Washington, *Vegetation, Classification, *Plant populations, Lake shores, Surveys, Taxonomy.

A botanical survey of Silver Lake Research Natural Area in the North Cascade National Park in northern Washington recorded 109 vascular plant taxa representing 27 families, including 2 sensitive species. This research note provides baseline information on the distribution, habitats, and abundance of vascular plants within the Silver Lake Research Natural Area. (Author's abstract)
W87-07654

REPORT OF THE AQUATIC ECOSYSTEM OBJECTIVES COMMITTEE: 1985 ANNUAL REPORT.
International Joint Commission-United States and Canada, Windsor (Ontario). Standing Committee on the Scientific Basis for Water Quality Criteria.
For primary bibliographic entry see Field 5G.
W87-07724

FOOD FOR FLIGHT IN DELAWARE BAY,
C. Joyce.
New Scientist NWSCAL, Vol. 112, No. 1529, p 34-36, October 1986.

Descriptors: *Shorebirds, *Mud flats, *Migration, *Delaware bay, Copper river delta, Gray's harbor, Bay of Fundy, Horseshoe crabs, Pesticides, Wetlands, Conservation.

Shorebirds migrating up through US and Canada congregrate in the few places big enough to feed them. Four such places in North America support more than one millian shorebirds each during migration. These are Deleware Bay, Copper River Delta in Alaska, Gray's Harbor in Washington state, and the bay of Fundy in Canada. Each supports about 80 percent of the bredding population of one or more species. Loss of significant amount of any of these feeding ground will affect the bird population. Studies conducted in Massachusets show that ten of the twelve species observed have declined in number. The exact cause of this decline is not known. Scientists are trying to determine whether pesticides or toxic metals like selenium or arsenic are responsible for the decline of bird popullation. Conservationists fear that loss of aquatic habitats will affect bird population seriously and are organizing a Weatern Hemisphere Shorebird Reserve Network for the Americas with the cooperation of International Association of Fish and Wildlife Agencies. (Ray-PTT)
W87-07800

CYCLIC AND STABLE POPULATIONS: PLANKTON AS PARADIGM,
California Univ., Santa Barbara. Dept. of Biological Sciences.
E. McCauley, and W. W. Murdoch.
The American Naturalist AMNTA4, Vol. 129, No. 1, p 97-121, January 1987. 11 fig, 3 tab, 63 ref. NSF Grant BSR 83-15235.

Descriptors: *Plankton, *Population dynamics, *Daphnia, *Algae, *Limnology, Aquatic life.

Twenty study-years of data from populations of Daphnia and algae in a wide variety of field situations have been analyzed. These systems display three types of dynamic behavior: both populations stable; both populations cyclic; and Daphnia cyclic but algae stable. The last pattern occurs whether we analyze the total amount of algae or only edible algae. There is evidence that this range of dynamics arises from the interaction between Daphnia and its food supply, occurring in systems that are structurally the same; that is, differences in biological rates or time delays, alone, can explain the existence of different dynamic classes. This is particularly the case when different classes occur in the same species in the same environment in different years, or in similar or adjacent habitats at the same time. The cycles thus appear to be internally driven, rather than resulting from external, cyclic, forcing factors. These findings support a basic premise of most mathematical models in ecology. The broad dynamic patterns in cyclic field populations of Daphnia are similar to those found in laboratory populations. The two sets of cycles have very similar periods and (small) amplitudes; both are single-generation cycles (i.e., the period of a cycle is one generation); and both are caused by dominance and suppression, whereby each cohort suppresses reproduction until its density declines sufficiently to allow production of another cohort. The demographic features of laboratory and field cycles are also similar in detail. Since algae are dynamic in the field but not in the laboratory, we cannot conclude that the mechanisms driving laboratory and field cycles are identical. Our hypothesis is that the presence or absence of cycles is determined by the relationships between time delays in Daphnia and other rates in the interacting populations. There is, however, no obvious environmental factor affecting these rates and delays, thereby determining which dynamic class a particular system fits at a particular time. It does not appear that change in the average temperature is the critical factor. Similar single-generation cycles appear to occur in other systems and may be driven by similar dominance-and-suppression mechanisms. (Authors abstract)
W87-07812

OCCURRENCE PATTERNS OF RIPARIAN PLANTS AND THEIR SIGNIFICANCE TO WATER RESOURCE DEVELOPMENT,
Wisconsin Univ.-River Falls. Dept. of Plant and Earth Sciences.
R. R. Harris.
Biological Conservation BICOBK, Vol. 38, No. 3, p 273-286, November 1986. 4 fig, 2 tab, 31 ref.

Descriptors: *Riparian vegetation, *Riparian waters, *Plant populations, Flood plains, Bottomland, Alluvial plains.

The objective was to determine if riparian plant species on California floodplains are distributed in patterns related to the frequency and intensity of flooding. Such information would be important for predicting the impacts of water resource development on riparian vegetation. Changes in natural streamflow and geomorphic processes can effect the distributions of plants due to induced changes in the environmental characteristics of floodplains. Data were collected on an alluvial floodplain in central California to evaluate relationships between streamflow and distribution of common plant species. Analysis showed that species differed in location on the floodplain and tolerance to the effects of flooding. Three floodplain zones each had characteristic species: recent depositional surfaces less than 2 m elevation; 2-5 m; and terraces greater than 5 m elevation above the channel bottom. Water resource development may affect the streamflow regime in these zones and consequently may affect the distribution and abundance of different species. (Author's abstract)
W87-07815

VARIATION IN SHELL CHEMISTRY OF TERRESTRIAL GASTROPODS (CERION INCANUM, CERION UVA, AND TUDORA MACULATA) FROM THE FLORIDA KEYS AND BONAIRE,
Brock Univ., St. Catharines (Ontario). Dept. of Geological Sciences.
For primary bibliographic entry see Field 2L.
W87-07825

EXPERIMENTAL STUDY ON THE EFFECT OF ELEVATED TEMPERATURE ON THE HETEROTROPHIC AND AUTOTROPHIC FOOD RESOURCES OF AQUATIC INSECTS IN A FORESTED STREAM,
Waterloo Univ. (Ontario). Dept. of Biology.
R. S. Rempel, and J. C. H. Carter.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 11, p 2457-2466, November 1986. 5 fig, 8 tab, 42 ref.

Descriptors: *Aquatic insects, *Aquatic productivity, *Decomposition, *Cycling nutrients, *Temperature effects, Respiration, Detritus, Decomposing organic matter, Stream biota.

The effect of temperature on the heterotrophic and autotrophic food resources of aquatic insects was investigated in outdoor experimental channels and in the laboratory. Elevated temperatures in outdoor channels resulted in accelerated decay rates and accumulation of organic layers on introduced tiles. Heterotrophic activity (substrate respiration)

increased with temperature in the laboratory for leaf strips, flocculent organic matter, and stone surface organic layers. Autotrophic activity (substrate photosynthesis) was greater in the laboratory for flocculent detritus (per mg ash-free dry wt) than for stone surface organic layers. These results indicate that the primary food resources of shredder, collector, and scraper functional guilds are enhanced by elevated temperature, but also suggest that coarse particulate organic matter may disappear from the stream more quickly. The results also point out that substantial autotrophic activity occurs within flocculent organic detritus. (Authors' abstract)
W87-07826

RELATION OF LAKE BED LEAKANCE TO GEOLOGICAL PROPERTIES,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W87-07847

EFFECT OF AMBIENT OXYGEN CONCENTRATION ON MEASUREMENTS OF SEDIMENT OXYGEN CONSUMPTION,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 7B.
W87-07872

SEDIMENT DIATOM AND METAL STRATIGRAPHY FROM ROCKY MOUNTAIN LAKES WITH SPECIAL REFERENCE TO ATMOSPHERIC DEPOSITION,
Colorado State Univ., Fort Collins. Natural Resources Ecology Lab.
For primary bibliographic entry see Field 5B.
W87-07873

PATTERNS IN THE COMPOSITION OF ARCTIC TUNDRA POND MICROCRUSTACEAN COMMUNITIES,
Windsor Univ. (Ontario). Dept. of Biology.
P. D. N. Hebert, and B. J. Hann.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 7, p 1416-1425, July 1986. 3 fig, 4 tab, 66 ref.

Descriptors: *Species composition, *Distribution patterns, *Arctic, *Tundra, *Ponds, *Aquatic environment, *Species diversity, Ecological distribution, Polar regions, Environment, Ecology, Zooplankton, Plankton, Canada, Climatic zones, Migration, Glaciation, Glaciers, Copepods.

Patterns of species richness, distribution, and community composition were evaluated on the basis of intensive collections of Microcrustacea (Cladocera, Copepoda, Anostraca, and Notostraca) from 11 sites in the Canadian arctic archipelago. Microcrustacean communities of pond habitats in the high arctic of Canada are much less diverse than communities at more mesic, subarctic sites. There is both a marked decline in species richness and a dramatic change in the composition of pond communities with increasing latitude and decreasing summer temperatures. Ponds in the low arctic have 3-4 times as many species as those in the high arctic and are dominated by calanoid copepods, a group largely absent from the high arctic. Sites with similar climatic conditions in Alaska have microcrustacean communities with higher species richness, a phenomenon correlated partially with the presence of glacial refuges throughout the Pleistocene. The failure of certain zooplankton taxa, especially calanoids, to colonize areas in the Canadian arctic remote from refuges in the 7000 yr since deglaciation suggests that their dispersal rates are low. Reestablishment of complete zooplankton communities in glaciated terrain with severe environmental conditions apparently requires long periods, although initial colonization by a few pioneer species may be rapid. (Author's abstract)
W87-07874

EFFECT OF POINT AND DIFFUSE SOURCE LOADINGS ON MERCURY CONCENTRATIONS IN THE WABIGOON RIVER: EVIDENCE OF A SEASONALLY VARYING SEDIMENT-WATER PARTITION,
Ontario Ministry of the Environment, Thunder Bay (Ontario).
For primary bibliographic entry see Field 5B.
W87-07875

ZOOPLANKTON AND FISH ACCUMULATE CHLORINATED HYDROCARBONS FROM CONTAMINATED SEDIMENTS,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 5B.
W87-07876

PHOSPHATE UPTAKE RATES OF PHYTOPLANKTON ASSEMBLAGES GROWN AT DIFFERENT DILUTION RATES IN SEMICONTINUOUS CULTURE,
British Columbia Univ., Vancouver. Dept. of Botany.
C. A. Suttle, and P. J. Harrison.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1474-1481, August 1986. 5 fig, 1 tab, 54 ref.

Descriptors: *Limnology, *Phosphates, *Bioaccumulation, *Phytoplankton, *Culturing techniques, *Nutrients, *Physiological ecology, *Aquatic environment, Plankton, Aquatic plants, Lakes, Oligotrophic lakes, Environment, Nitrogen, Phosphorus.

The effects of pulsed nutrient supplies were studied on the physiology of natural phytoplankton assemblages. A natural phytoplankton community from an oligotrophic lake was grown at several dilution rates from 0.1 to 1.5/d in P-limited semicontinuous cultures. Particulate C:P and N:P rations (by atoms) were approximately 300:1 and 50:1, respectively, at the lowest dilution rate, and 40:1 and 7:1, respectively, at the highest dilution rate. This demonstrates that a range of P-limited conditions can be established using the semicontinuous culturing technique. The time-course of uptake, in response to a saturating addition of phosphate, revealed that there was a short lag before maximum rates of uptake were observed at all but the highest dilution rate, and that maximum uptake rates over the first 30 min of incubation were higher at intermediate dilution rates. Subsequent to the maximum uptake rate occurring, the relationship between uptake rate and time was species dependent. In Oscillatoria sp., the uptake rates declined with increasing cellular P, and the rates of these declines increased with dilution rate; in cultures dominated by Synechococcus sp., the uptake rates remained constant and were independent of cellular P. (Author's abstract)
W87-07877

DOES ORTHOPHOSPHATE UPTAKE SUPPLY SUFFICIENT PHOSPHORUS TO PHYTOPLANKTON TO SUSTAIN THEIR GROWTH,
Montreal Univ. (Quebec). Dept. of Biological Sciences.
D. J. Currie.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1482-1487, August 1986. 1 fig, 2 tab, 65 ref.

Descriptors: *Orthophosphates, *Bioaccumulation, *Phytoplankton, *Phosphorus, *Nutrient requirements, *Algal growth, *Aquatic environment, Environment, Nutrition, Algae, Accumulation, Plankton, Aquatic plants, Nutrients, Ecology, Carbon, Growth rates, Lakes, Oligotrophic lakes.

A study was undertaken to test the hypothesis that orthophosphate uptake constitutes the principal source of P for phytoplankton growth. This was tested by comparing specific doubling rates of C and P through orthophosphate uptake in the phytoplankton community of a large, hardwater, oligomesotrophic lake 100 km southeast of Montreal. The P doubling rate was estimated from the specific rate of orthophosphate uptake (gross uptake of P as orthophosphate per unit time, per unit P in biomass). The C doubling rate was estimated from the primary production rate divided by the algal particulate carbon, the latter estimated by the 14C rate. It was found that phytoplankton doubled their P by orthophosphate uptake much more slowly than they doubled their C; therefore, phytoplankton, particularly those larger than 3.0 microns, must have obtained negligible P from orthophosphate, at least for most of the summer. It is suggested that algae get most of their P from uptake of dissolved organic P or by some process other than direct uptake from solution (possibly by transfer from bacteria). (Author's abstract)
W87-07878

BACTERIOPLANKTON, PHYTOPLANKTON, AND ZOOPLANKTON COMMUNITIES IN A BRITISH COLUMBIA COASTAL LAKE BEFORE AND AFTER NUTRIENT REDUCTION,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
F. J. Hardy, K. S. Shortreed, and J. G. Stockner.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1504-1514, August 1986. 7 fig, 2 tab, 69 ref.

Descriptors: *Limnology, *Aquatic bacteria, *Phytoplankton, *Zooplankton, *British Columbia, *Nutrient requirements, *Lakes, *Coasts, *Physiological ecology, Bacteria, Plankton, Aquatic plants, Nutrients, Nitrogen compounds, Phosphorus compounds, Environment, Aquatic environment, Chlorophyll, Density, Population, Diatoms, Algae, Cyanophyta, Algal growth, Salmon, Rotifers, Aquatic animals.

The effects of lake fertilization on pelagic and phytoplankton communities were studied in a warm monomictic coastal lake in British Columbia. Inorganic N and P were applied once or twice weekly from 1980-1983. Average numbers of bacteria during the growing season decreased from a high of 1,530,000/ml in the fertilized condition to 840,000/ml in the unfertilized condition (1984). Chlorophyll a concentrations decreased from a maximum seasonal average of 2.69 micrograms/l (1981) to 1.30 micrograms/l (1984), and algal numbers decreased from 58,300/ml (1983) to 22,900/ml (1984). Although the numbers of phytoplankton in each size fraction decreased in the unfertilized condition, the greatest change was an almost fourfold decrease in picoplankton, which consisted of 90% cyanobacteria. Abundance of the large diatoms Rhizosolenia spp. and Melosira spp. increased in 1984, resulting in an increase in average seasonal algal volume. Average densities of medium (0.15-0.84 mm) and large (0.85-1.5 mm) zooplankton were greatest in 1982, while rotifers and small zooplankton (0.10-0.14 mm) were most dense in 1984 following nutrient reduction. The lake had relatively high concentrations of planktivorous juvenile sockeye salmon (Oncorhynchus nerka) that appeared to minimize any direct effect of nutrient additions on zooplankton densities. (Author's abstract)
W87-07881

TROPHIC RELATIONSHIPS IN FRESHWATER PELAGIC ECOSYSTEMS,
York Univ., Downsview (Ontario). Dept. of Biology.
D. J. McQueen, J. R. Post, and E. L. Mills.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1571-1581, August 1986. 6 fig, 2 tab, 65 ref.

Descriptors: *Limnology, *Trophic level, *Aquatic environment, *Ecosystems, *Nutrient requirements, *Aquatic animals, *Aquatic plants, *Food chains, *Regression analysis, Environment, Ecology, Aquatic life, Zooplankton, Phytoplankton, Plankton, Biomass, Prediction, Lakes, Oligotrophic lakes, Mathematical studies, Model studies.

Relative impacts of bottom-up (producer controlled) and top-down (consumer controlled) forces on the biomass and size structure of five major components of freshwater pelagic systems (piscivores, planktivores, zooplankton, phytoplankton, and total phosphorus availability) were estimated based on empirically-derived regressions. Predictions that emerge are (1) maximum biomass at each trophic level is controlled from below

(bottom-up) by nutrient availability, (2) this bottom-up regulation is strongest at the bottom of the food web and weakens by a factor of 2 with each succeeding step up the food web, (3) as energy moves up a food web, the predictability of bottom-up interactions decreases, (4) near the top of the food web, top-down (predator mediated) interactions are strong and have low coefficients of variation, but weaken with every step down the food web, (5) variability around the bottom-up regressions can always be explained by top-down forces, and (6) interplay between top-down and bottom-up effects changes with the trophic status of lakes. (Author's abstract)
W87-07884

DISTRIBUTION OF THE STONEFLY NYMPH PARAGNETINA MEDIA (PLECOPTERA:PERLIDAE): INFLUENCE OF PREY, PREDATORS, CURRENT SPEED, AND SUBSTRATE COMPOSITION,
Toronto Univ. (Ontario). Dept. of Zoology.
B. W. Feltmate, R. L. Baker, and P. J. Pointing.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1582-1587, August 1986. 5 fig, 26 ref.

Descriptors: *Stoneflies, *Ecological distribution, *Predation, *Water currents, *Substrates, *Aquatic habitats, Ecology, Distribution, Distribution patterns, Aquatic insects, Habitats, Trout, Fish, Ontario.

Effects of prey distribution, presence of a predator, current speed, and substrate composition on distribution of the predaceous stonefly nymph Paragnetina media (Walker) were examined in a large laboratory stream. Distribution of prey (Hydropsyche sparna, H. bronta) did not affect distribution of well-fed or non-fed (48 h) nymphs. However, P. media distribution was significantly influenced by independent and interactive effects of current speed (0.33-0.41 m/s) and substrate composition (53.0-110.0 mm in diameter). In the presence of rainbow trout (Salmo gairdneri), P. media selected more specifically for larger substrate on which risk of predation was less than on smaller size classes. Lighting condition had no effect on substrate selection. Laboratory findings were consistent with distribution of P. media observed in the Credit River, Ontario during mid-summer, late fall, and early spring. It is concluded that prey distribution does not affect P. media distribution, current speed and substrate composition have an interactive effect, and risk due to predation influences substrate selection. Factors traditionally considered as either biotic or abiotic are often related and should not be considered separately. (Author's abstract)
W87-07885

WOODY DEBRIS AS A SOURCE OF FINE PARTICULATE ORGANIC MATTER IN CONIFEROUS FOREST STREAM ECOSYSTEMS,
Alabama Univ., University. Aquatic Biology Program.
G. M. Ward, and N. G. Aumen.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1635-1642, August 1986. 4 fig, 2 tab, 26 ref. NSF Grants DEB 81-12455 and DEB 80-04652.

Descriptors: *Nutrients, *Ecosystems, *Wood wastes, *Detritus, *Organic matter, *Particulate matter, *Coniferous forests, *Streams, *Ecosystems, Wastes, Forests, Ecology, Oregon, Distribution, Vertical distribution, Particle size, Lignin, Soil organic matter, Decomposing organic matter, Litter, Microscopy, Electron microscopy.

The potential contribution of woody debris to fine particulate organic matter (FPOM) pools (0.45 microns to < 1 mm) was investigated in a coniferous forest stream ecosystem in western Oregon. The amount of wetted surface area of both large (> 10 cm) and fine (1-10 cm) woody debris was 0.018 and 0.069 sq m/sq m of stream bed, respectively, during summer base flow. These values increase to 0.062 and 0.195 sq m/sq m stream bed during winter flows. Studies of vertical distribution indicated that most fine wood is concentrated within 0.3 m of the stream bottom, while large wood is more evenly distributed up to 0.7 m. Lignin concentrations of large wood, soil, and FPOM were very similar. Examination of FPOM samples with scanning electron microscopy revealed an abundance of wood-derived particles. Erosion rates of wood surfaces ranged between 0.5 and 11 mm/yr depending on decay state of the log. Using conservative estimates of processing rates, woody debris could be a source for approximately 90 g/sq m/yr of FPOM; with a slightly less conservative estimate, wood processing may generate several times the FPOM that is contributed by leaf and needle litter. (Author's abstract)
W87-07886

SIMPLE METHOD OF MEASURING SESTON RESPIRATION IN OLIGOTROPHIC LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. J. Cornett, and F. H. Rigler.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1660-1663, August 1986. 2 fig, 1 tab, 24 ref.

Descriptors: *Limnology, *Seston, *Respiration, *Oligotrophic lakes, *Oxygen requirements, *Filtration, Lakes, Filters, Kinetics, Oxygen, Oxygen deficit, Hypolimnion.

A simple technique for measuring the oxygen consumption of seston in oligotrophic waters was developed and tested. Water samples were filtered through 0.45-micron filters. The filters were suspended in biological oxygen demand bottles containing lake water. NaN3 added to one bottle stopped respiration and served as a control to eliminate abiotic influences during the experiments. The difference in oxygen concentration between the respiring and control samples increased linearly over the one-day experiments. Filtration of hypolimnetic water samples did not significantly alter the rate of oxygen consumption of the seston. Concentrating the seston increased the change in oxygen concentration so that respiration rates from 2 to 80 mg O2/cu m/d could be measured. This method is simple, precise, and can measure very low rates of respiration directly. (Author's abstract)
W87-07887

PLANKTON SIZE SPECTRA IN RELATION TO ECOSYSTEM PRODUCTIVITY, SIZE, AND PERTURBATION,
Toronto Univ. (Ontario). Inst. of Aerophysics.
W. G. Sprules, and M. Munawar.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1789-1794, September 1986. 4 fig, 2 tab, 28 ref.

Descriptors: *Limnology, *Plankton, *Ecosystems, *Aquatic productivity, *Biomass, *Bioindicators, *Lakes, Productivity, Ontario, Oligotrophic lakes, Indicators, Environment, Aquatic environment, Nutrients, Stress, Toxicity, Monitoring, Fish, Zooplankton, Trophic level, Eutrophication, Bays.

Quantification and comparisons of the structure of open-water plankton communities from 25 inland lakes of Ontario, from the Laurentian Great Lakes Superior, Huron, St. Clair, Ontario, and Erie, and from the Central Gyre in the North Pacific Ocean were made on the basis of the normalized biomass size spectrum. Residual variation around the fitted straight lines (corresponding to a theoretical steady state) was least for the large, oligotrophic Lake Superior and the North Pacific Gyre and greatest for eutrophic Saginaw Bay and shallow Lake Erie, suggesting progressive departure from steady-state conditions with increasing system productivity. The slopes of the normalized spectra decrease with increasing eutrophy, indicating that nannoplankton abundances are similar in all communities studied, but that associated zooplankton abundances vary by 2.5 orders of magnitude. It is concluded that parameterization of particle-size models for prediction of potential fish production must be adjusted according to the size and productivity of the ecosystem, and that routine monitoring of communities by the normalized biomass spectrum could provide early warning of nutrient or toxic stress in aquatic ecosystems. (Author's abstract)
W87-07892

HYPERSALINE GRADIENTS IN TWO CANADIAN HIGH ARCTIC LAKES,
State Univ. of New York at Buffalo. Dept. of Biological Sciences.
K. M. Stewart, and R. F. Platford.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1795-1803, September 1986. 6 fig, 5 tab, 61 ref.

Descriptors: *Hypersaline gradient, *Limnology, *Saline lakes, *Vertical distribution, *Arctic, *Canada, *Meromictic lakes, *Chemical stratification, *Thermal stratification, Lakes, Distribution, Polar regions, Fjords, Brackish water, Saline water, Ions, Oxygen, Chemocline, Permafrost, Stratification, Physical properties, Chemical properties, Convection, Thermocline.

Comparative limnological data from two meromictic lakes are examined, along with the development of hypersaline gradients. Sophia and Garrow lakes are probably saline relicts of cutoff fjords on the uplifted Cornwallis and Little Cornwallis islands in the High Arctic of the Canadian Archipelago. They have brackish (S = 2-4) upper and hypersaline (S = 55-90) lower waters with ion ratios (especially the lower waters) similar to that of the sea. Substantial oxygen extends well below the chemocline in Sophia. The stability of these lakes is among the highest known. Because of their size, depth, and unusually warm lower waters, it is suggested that an unfrozen 'thermal chimney' extends beneath the lakes through the surrounding permafrost; and that the hypersaline gradients evolved primarily by descent of 'salt fingers' during freeze-out from above, and not by solute rejection from the ground during uplift and permafrost growth, or through taliks connected to the sea, as proposed by Page et al. (Author's abstract)
W87-07893

ANALYSIS OF THE PHYTOPLANKTON COMPOSITION OF 95 LABRADOR LAKES, WITH SPECIAL REFERENCE TO NATURAL AND ANTHROPOGENIC ACIDIFICATION,
Waterloo Univ. (Ontario). Dept. of Biology.
J. C. Earle, H. C. Duthie, and D. A. Scruton.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1804-1811, September 1986. 2 fig, 2 tab, 20 ref.

Descriptors: *Limnology, *Phytoplankton, *Labrador, *Species composition, *Chemical properties, *Dystrophic lakes, *Acidic water, *Statistical analysis, Environment, Aquatic environment, Lake morphometry, Density, Population density, Water properties, Physical properties, Biological properties, Physicochemical properties, Hardness, Dystrophy, Trophic level, Lakes, Acidity, Salinity, Oligotrophy.

Phytoplankton abundances and accompanying morphometric, physical, and chemical data from 95 Labrador lakes were subjected to statistical analysis to determine the structure of the phytoplankton communities and to relate environmental factors to the patterns observed. Factor analysis of the 22 measured physical and chemical variables reduced the data to six derived environmental factors: hardness, dystrophy, lake size, salinity, oligotrophy, and seasonality. The analysis showed that the low-pH lakes are associated with dystrophy and hence are likely to be naturally acidic. There was no evidence of anthropogenic acidification. Eight groups of co-occurring taxa were recognized from the data set, of which all but two exhibited relatively consistent habitat preferences. It was suggested that the groups represent 'species associations' in the sense that each group contains taxa that occur together because of similar requirements for a specific set of environmental conditions. Several lake types were identified as potentially influencing the distribution of phytoplankton in Labrador: small dystrophic lakes, clear softwater lakes, clear hardwater lakes, large hardwater lakes, and colored hardwater lakes. (Author's abstract)
W87-07894

THREE-DIMENSIONAL DISTRIBUTION OF WINTER STONEFLY NYMPHS, ALLOCAPNIA PYGMAEA, WITHIN THE SUBSTRATE OF A SOUTHERN ONTARIO RIVER,

Waterloo Univ. (Ontario). Dept. of Biology.
C. W. Pugsley, and H. B. N. Hynes.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1812-1817, September 1986. 5 fig, 24 ref.

Descriptors: *Limnology, *Spatial distribution, *Stoneflies, *Allocapnia, *Substrates, *Ontario, *Streambeds, *Immature growth stage, *Aquatic insects, *Rivers, Environment, Aquatic environment, Monitoring, Gravel, Growth stages, Distribution, Vertical distribution, Ecological distribution, Distribution patterns, Migration, Life cycles.

Changes in the three-dimensional distribution patterns of stonefly nymphs, Allocapnia pygmaea, beneath the streambed in the Speed River, southern Ontario, were monitored throughout their 1-yr cycle using 270 colonization chambers which were filled with organism-free, sieved stream gravel and buried in vertical groups of three, at three depth intervals, in three trenches positioned across a riffle. Nymphs were present throughout the year. Seasonal changes in the distribution pattern of nymphs indicated that they were able to move beneath the streambed in both the horizontal and vertical planes. Nymphs were most abundant at depth during the summer diapause, but moved up to the surface once diapause had been broken in the autumn. There was no evidence of any bankwards migration of nymphs prior to emergence. These results confirm in detail previous suggestions that stream insects move freely into and out of the hyporheic, using it as a refuge from adverse conditions on the streambed. It is suggested that stream ecologists should be aware of the possibilities of movement to and from the hyporheic when working with benthic invertebrates. (Author's abstract)
W87-07895

RELATIONSHIPS BETWEEN STREAM AND INTRAGRAVEL TEMPERATURES IN COASTAL DRAINAGES, AND SOME IMPLICATIONS FOR FISHERIES WORKERS,

Department of Fisheries and Oceans, Vancouver (British Columbia).
B. G. Shepherd, G. F. Hartman, and W. J. Wilson.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1818-1822, September 1986. 2 fig, 1 tab, 21 ref.

Descriptors: *Limnology, *Stream fisheries, *Gravel, *Streambeds, *Temperature, *Water temperature, *Thermal properties, Fisheries, Physical properties, Substrates, Coasts, Seasonal variation, Salmon.

The relationship between intragravel and surface water temperatures is of importance to fisheries workers and other resource managers. At a depth of 10 cm into the streambed, water temperatures are likely to be different from those in the open water of the stream. Combined results from three independent studies on disparate streams on the Pacific Northwest coast indicated that there are widespread similarities in the thermal behavior of intragravel water. In general, the thermal mass of the substrate causes parallel but lagged and buffered heating and cooling trends in infiltration-source intragravel water compared with surface water. Intragravel mean daily temperatures were generally 0.5-1.0 C warmer in winter and 0.5-1.5 C cooler in summer, with cross-overs around March and October; intragravel daily maximum temperatures could be up to 6 C different in summer (a difference of 4 C was common). The degree of difference showed considerable site-specific variation, and potentially can be affected by several factors. Such intragravel temperature differences have implications for those involved in salmonid egg incubation and fry emergence studies, enhancement projects, benthic invertebrate research, and environmental impact assessments. (Author's abstract)
W87-07896

EFFECTS OF A SHORT-TERM EXPERIMENTAL ACIDIFICATION ON A MICROINVERTEBRATE COMMUNITY: RHIZOPODA, TESTACEA,

Quebec Univ., Montreal. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-07897

INFLUENCE OF WATER TEMPERATURE ON BEHAVIOURAL INTERACTIONS BETWEEN JUVENILE BROOK CHARR, SALVELINUS FONTINALIS, AND RAINBOW TROUT, SALMO GAIRDNERI,

Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
R. A. Cunjak, and J. M. Green.

Canadian Journal of Zoology CJZOAG, Vol. 64, No. 6, p 1288-1291, June 1986. 1 fig, 3 tab, 25 ref.

Descriptors: *Limnology, *Temperature effects, *Trout, *Charr, *Fish behavior, *Aquatic habitats, *Streams, Fish, Behavior, Habitats, Temperature, Water temperature, Physical properties, Ecology.

Interspecific behavioral interactions between paired brook charr (Salvelinus fontinalis) and rainbow trout (Salmo gairdneri) were compared at different water temperatures to test the hypothesis that a species realizes a competitive advantage within its optimal thermal range. Three test temperatures were used: 19 C (optimal temperature for rainbow trout), 13 C (optimal temperature for brook charr), and 8 C (below the optima for both species). Brook charr dominated rainbow trout at both 8 and 13 C. At 19 C, neither species displayed an obvious competitive advantage. The time (days) to the establishment of a dominance hierarchy reflected specific optimal temperatures; it was shortest for rainbow trout and brook charr at 19 and 13 C, respectively. The implications of optimal temperatures and competitive ability are discussed in relation to habitat partitioning in the stream environment. (Author's abstract)
W87-07898

RESPONSE OF STREAM BENTHOS AND DRIFT TO FINE SEDIMENT DEPOSITION VERSUS TRANSPORT,

Calgary Univ. (Alberta). Aquatic Ecology Section.
J. M. Culp, F. J. Wrona, and R. W. Davies.

Canadian Journal of Zoology CJAOAG, Vol. 64, No. 6, p 1345-1351, June 1986. 1 fig, 5 tab, 26 ref.

Descriptors: *Limnology, *Sedimentation, *Benthic fauna, *Sediment transport, *Deposition, *Invertebrates, *Population density, *Ecological effects, *Saltation, *Drift, Aquatic life, Benthos, Tractive forces, Sediments, Sedimentation, Density, Streams, Species composition, Riffles, Flow, Distribution, Vertical distribution, Scour, Hydrographs.

Field experiments were conducted to investigate the responses of benthic macroinvertebrate communities to additions of fine sediments into riffles having a flow with either low tractive force so the sediments were deposited or sufficient tractive force to transport the added sediments. Sediment deposition had no measurable impact on most taxa. Sediment transport by saltation created a physical disturbance that reduced total benthic densities by > 50% in 24 h and significantly influenced macroinvertebrate community composition. Changes in the benthic community resulted from catastrophic drift, and distinct immediate and delayed responses of diurnal drift to the saltating sediments were evident. Taxa with the immediate drift response resided predominantly at the substrate surface and were instantaneously exposed to scouring as sediments were added. Macroinvertebrates showing the delayed response initially avoided the saltating sediments because of their deeper distribution, but an apparent diel shift in vertical distribution exposed these taxa to saltating sediments 6-9 h after sediment additions. It is concluded that sediment saltation has the potential to act as a community-level disturbance early in the storm hydrograph or at lower discharge magnitudes than required to suspend sediments. (Author's abstract)
W87-07899

ECOLOGY AND COEXISTENCE OF TWO SPECIES OF BRACHYCENTRUS (TRICHOPTERA) IN A ROCKY MOUNTAIN RIVER,

Montana Univ., Bigfork. Biological Station.
F. R. Hauer, and J. A. Stanford.

Canadian Journal of Zoology CJZOAG, Vol. 64, No. 7, p 1469-1474, July 1986. 5 fig, 3 tab, 29 ref. EPA Grant R008223213.

Descriptors: *Limnology, *Brachycentrus, *Caddisflies, *Rocky Mountains, *Rivers, *Aquatic environment, *Growth rates, *Population density, *Phenology, Aquatic insects, Life history studies, Environment, Density, Runoff, Growth stages, Larval growth stage, Mature growth stage, Growth, Life cycles, Ecology, Ecosystems, Seston, Physicochemical properties, Water properties.

Life-cycle dynamics, growth rates, and relative abundance of Brachycentrus occidentalis and Brachycentrus americanus were studied over a three-year period in the Flathead River, Montana. Brachycentrus occidentalis appeared as early-instar larvae in mid- to late summer, grew rapidly during autumn, and reached fourth and fifth instars prior to winter conditions. Most larvae remained active until mid-spring and the onset of spring runoff. Individuals pupated during late April through May, and adults emerged after peak runoff in mid-June. Brachycentrus americanus larvae appeared as first-instar larvae in autumn and overwintered as early instars. Larvae grew rapidly during spring as temperatures began to rise, but growth was discontinued during spring runoff. Larvae completed growth during summer after the runoff period and emerged in late August and early September. Growth patterns and emergence of both species occurred primarily during fall or spring and late summer, with little growth during winter or spring freshet. Thus, growth was associated with quantitatively similar but temporally different periods of organic seston, temperature, and moderate flow. (Author's abstract)
W87-07900

SEASONAL OCCURRENCE OF, DEVELOPMENT OF, AND THE INFLUENCES OF SELECTED ENVIRONMENTAL FACTORS ON THE LARVAE OF PROSIMULIUM AND SIMULIUM SPECIES OF BLACKFLIES (DIPTERA:SIMULIIDAE) FOUND IN THE RIVERS OF SOUTHWESTERN ALBERTA,

Department of Agriculture, Lethbridge (Alberta). Research Station.
J. L. Shipp, and W. S. Procunier.

Canadian Journal of Zoology CJZOAG, Vol. 64, No. 7, p 1491-1499, July 1986. 5 fig, 7 tab, 31 ref.

Descriptors: *Blackflies, *Alberta, *Rivers, *Aquatic environment, *Larval growth stage, *Limnology, *Phenology, Environment, Aquatic insects, Growth stages, Temperature, Water temperature, Flow, River flow, Turbidity, Growth, Food habits, Life cycles, Physical properties.

Larval development of Simulium arcticum Malloch (IIL-3), S. defoliarti Stone and Peterson (IIS-14.15), and S. tuberosum Lundstrom (FG) was documented for four rivers in southwestern Alberta from 1982 to 1984. Simulium arcticum (IIL-3) and S. tuberosum (FG) had seven instars; these two species were multivoltine with two or three generations per year, while S. defoliarti (IIS-14.15) was univoltine. Water temperature, river discharge, and turbidity were the only environmental factors of five parameters measured that were significantly correlated with the seasonal development of larvae of S. arcticum (IIL-3), S. defoliarti (IIS-14.15), S. vittatum Zetterstedt complex, S. tuberosum (FG), and Prosimulium onychodactylum Dyar and Shannon complex. The effect that food quality and quantity have on larval growth and development of blackfly species that breed in mountain rivers is discussed. (Author's abstract)
W87-07901

SYMBIOSIS BETWEEN SALAMANDER EGGS AND GREEN ALGAE: MICROELECTRODE MEASUREMENTS INSIDE EGGS DEMONSTRATE EFFECT OF PHOTOSYNTHESIS ON OXYGEN CONCENTRATION,

Iowa State Univ., Ames. Dept. of Animal Ecology.
M. D. Bachmann, R. G. Carlton, J. M. Burkholder, and R. G. Wetzel.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 7, p 1586-1588, July 1986. 3 fig, 11 ref. DOE Grant EY-76-S-02-1599, COO-1599-245.

Descriptors: *Limnology, *Salamanders, *Symbiosis, *Eggs, *Chlorophyta, *Electrodes, *Photosynthesis, *Oxygen, *Algae, Amphibians, Respiration, Oxygen depletion, Growth stages, Embryonic growth stage, Measuring instruments.

Eggs of the spotted salamander, Ambystoma tigrinum, are usually green because of the presence of symbiotic chlamydomonad algae that inhabit the envelope of each egg. An oxygen-sensitive electrode was used to measure the effect of algal photosynthesis on oxygen concentration inside eggs and within the gelatinous matrix surrounding them. During darkness, oxygen became severely depleted within the eggs (mean oxygen concentration in two eggs 57 microM). Subsequent exposure of the egg to light produced an increase in oxygen concentration within an egg capsule from 63 to 476 microM within 32 min. One hour after eliminating the light, oxygen concentration within the egg was 9 microM, while the concentration in the gelatinous matrix and surrounding water were 160 and 91 microM, respectively. The data show that photosynthetic oxygen production by the chlamydomonads exceeded respiratory consumption by the embryo-algae complex and led to oxygen supersaturation inside eggs, even when water surrounding the egg mass was almost anoxic. (Author's abstract)
W87-07904

DETERMINATION OF PHOTOSYNTHETIC PIGMENT COMPOSITION IN AN INDIVIDUAL PHYTOPLANKTON CELL IN SEAS AND LAKES USING FLUORESCENCE MICROSCOPY; PROPERTIES OF THE FLUORESCENCE EMITTED FROM PICOPHYTOPLANKTON CELLS,
Mitsubishi-Kasei Inst. of Life Sciences, Tokyo (Japan).
For primary bibliographic entry see Field 7B.
W87-07943

NITROGEN METABOLISM OF THE EUTROPHIC DELAWARE RIVER ECOSYSTEM,
Harvard Univ., Cambridge, MA. Center for Earth and Planetary Physics.
F. Lipschultz, S. C. Wofsy, and L. E. Fox.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 701-716, July 1986. 12 fig, 4 tab, 33 ref. NSF Grant BSR 83-16359, EPA Grant R810219-01-0.

Descriptors: *Limnology, *Nitrogen cycle, *Metabolism, *Eutrophication, *Delaware River, *Aquatic ecosystems, *Physiological ecology, Nitrogen, Nitrogen compounds, Tracers, Isotopic tracers, Ecosystems, Chemical reactions, Ammonium, Nitrates, Rivers, Nitrification, Kinetics, Oxygen sag, Oxygen demand, Aeration, Oxygen, Chemical properties, Nitrites.

A comprehensive investigation of the nitrogen cycle in the Delaware River was carried out using 15N tracers to measure rates of important transformations of nitrogen. Daily, depth-averaged 15N rates for the principal inorganic nitrogen species were consistent with rates derived from longitudinal profiles of concentration in the river. The data indicated that nitrification was a rapid, irreversible sink for NH4(+) with export of the product NO3(-) from the study area. Utilization of NO3(-) by primary producers was negligible, owing to low irradiance levels and to high NH4(+) concentrations. The oxygen sag near Philadelphia was found to result from oxygen demand in the water column, with only minor benthic influence. Reaeration provided the major oxygen input. Nitrification accounted for about 1% of the net oxygen demand near Philadelphia, but as much as 25% farther downstream. (Author's abstract)
W87-07944

COMPOSITIONS AND FLUXES OF PARTICULATE ORGANIC MATERIAL IN THE AMAZON RIVER,
Washington Univ., Seattle. School of Oceanography.
J. I. Hedges, W. A. Clark, P. D. Quay, J. E. Richey, and A. H. Devol.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 717-738, July 1986. 8 fig, 5 tab, 88 ref. NSF Grant DEB 81-07522.

Descriptors: *Limnology, *Decomposing organic matter, *Particulate matter, *Organic matter, *Amazon River, *Chemical composition, Rivers, Isotope studies, Lignin, Hydrographs, Particle size, Leaves, Detritus, Fluctuations, Grasses, Flood plains, Catchment basins.

Lignin, elemental, and stable carbon isotope compositions are reported for local plants and for coarse (> 63 microns) and fine (< 63 microns) suspended particulate materials collected along a 1,950-km reach of the lower Amazon River during four contrasting stages of the 1982-1983 hydrograph. Fluxes of lignin in the two size classes parallel each other along the mainstem with the fine fraction usually predominating. Particulate organic matter transported in the coarse size fraction of the mainstem and its major tributaries is composed of recently formed and well preserved tree leaf debris along with some wood. Organic matter in the fine size fraction is comparatively old, degraded, and rich in immobilized nitrogen, and derives primarily from soils. C-4 grasses, abundant in the mainstem floodplain, are not major components of particulate material in the river. Particulate organic matter is introduced largely from upstream sources within the Rio Solimoes and Rio Madeira drainage basins. Most of this organic matter is unreactive and is transported conservatively with mineral particles along the Amazon mainstem. However, some downstream compositional trends are seen in both size fractions which reflect the addition or exchange of highly degraded, 13C-depleted, and lignin-poor organic materials from lower basin sources. (See also W87-07946) (Author's abstract)
W87-07945

DISSOLVED HUMIC SUBSTANCES OF THE AMAZON RIVER SYSTEM,
Washington Univ., Seattle. School of Oceanography.
J. R. Ertel, J. I. Hedges, A. H. Devol, J. E. Richey, and M. N. Goes Ribeiro.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 739-754, July 1986. 7 fig, 4 tab, 56 ref. NSF Grant: DEB 81-07522 and OCE 82-19294.

Descriptors: *Limnology, *Humic acids, *Amazon River, *Dissolved solids, *Fulvic acids, *Chemical compositon, *Chemical properties, *River systems, Acids, Organic acids, Rivers, Lignin, Diagenesis, Carbon, Nitrogen, Degradation, Chemical reactions, Adsorption, Fluctuations, Solute transport.

Aquatic humic and fulvic acids from nine mainstem and seven major tributary sites in the Amazon River Basin are characterized by their elemental and lignin phenol compositions. Combined humic substances represent 60% of the riverine dissolved organic carbon, with fulvic to humic acid ratios in the mainstem averaging 4.7. All dissolved humic and fulvic acids have clearly recognizable lignin components at levels suggesting a predominantly allochthonous source. Lignin characteristics are dominated by diagenetic transformations, which include preferential loss of methoxylated structural units and oxidative degradation of lignin side chains. Fulvic acids have consistently lower lignin levels, lower lignin phenol methoxylation, higher acid:aldehyde ratios, and higher C:N ratios than coexisting humic acids, all indicative of greater aerobic degradation of the fulvic acid fraction. Humic and fulvic acids behave conservatively over most of the mainstem. Downstream of the Rio Negro confluence, humic acids appear to be selectively adsorbed onto fine suspended particles. Approximately 25 and 40% of the total fluxes of lignin and of carbon are represented in the dissolved humic substances. The annual flux of dissolved, chemically recognizable lignin in the Amazon River at Obidos is calculated to be 1.2 x 10 to the 11th power g/yr. (See also W87-07945) (Author's abstract)
W87-07946

COMPARISON OF MECHANISMS ENHANCING BIODEGRADABILITY OF REFRACTORY LAKE WATER CONSTITUENTS,
Konstanz Univ. (Germany, F.R.). Limnological Inst.
A. Geller.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 755-764, July 1986. 6 fig, 1 tab, 22 ref.

Descriptors: *Limnology, *Biodegradation, *Dissolved solids, *Organic matter, *Lakes, *Aquatic bacteria, *Aquatic environment, *Chemical properties, Degradation, Bacteria, Environment, Flavobacterium, Pseudomonas, Substrates, Seasonal variation, Decomposition, Radiation, Ultraviolet radiation, Nutrients, Incubation, Amino acids.

Bacterial degradation of macromolecular dissolved organic matter (DOM), aged under weakly photolytic conditions, was compared to that of the original compounds before and after provision of a cosubstrate. Pseudomonas sp., Flavobacterium sp., Erwinia sp., and macromolecules were isolated from the same lake water samples, one taken in winter and one in summer. Decomposition was determined by dissolved organic carbon (DOC) measurements, since UV absorbance did not give an accurate indication of loss rates. Both aging and the pulse dose of nutrients enhanced the accessibility of the refractory DOM to Pseudomonas sp. and Erwinia sp., while Flavobacterium sp. utilized the original substances most effectively. The original macromolecules were decomposed 12-22%, aging increased the available portions by a futher 5-10%, and provision of the cosubstrate (glutamic acid) enhanced degradation by 3-8% and by 20%. The constituents of the macromolecules in the winter sample rendered accessible by photolysis were energetically advantageous to Pseudomonas sp. and Erwinia sp. The degradable portions of the original and aged macromolecules were consumed within the first week of incubation, and the remainder was persistent. Provision of a nutrient pulse did not result in the production of enzymes that might have enabled the bacteria to assimilate the refractory remainder. Both mechanisms are thought to reduce the longevity of the refractory DOM in a stepwise manner in natural waters. (Author's abstract)
W87-07947

NET COMMUNITY PRODUCTION AND HYPOLIMNETIC NUTRIENT REGENERATION IN A MICHIGAN LAKE,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
J. T. Lehman, and T. Naumoski.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 788-797, July 1986. 9 fig, 3 tab, 26 ref. NSF Grant DEB 81-16428.

Descriptors: *Limnology, *Hypolimnion, *Oxygen balance, *Cycling nutrients, *Michigan, *Eutrophic lakes, *Aquatic productivity, *Chemical properties, Nutrients, Oxygen, Environment, Aquatic environment, Eddy diffusion, Fluctuations, Distribution, Vertical distribution, Nitrogen, Phosphorus, Seasonal variation, Biomass, Profiles, Accumulation, Algae, Littoral environment, Littoral zone, Zones, Metabolism, Lakes, Thermal stratification, Phosphates.

Net community oxygen production in Third Sister Lake, Michigan was calculated from concentration gradients, eddy diffusion, and gas flux at the lake surface. The trophogenic zone was found to extend on average to 4.5 m from April to August. The vertical flux of dissolved P provided negligible support for the productivity during this time. Stoichiometries for biomass production from inorganic N and P were inferred from enclosure experiments and from vertical profiles. N and P accumulated in the hypolimnion at a ratio of 24:1 by atoms, whereas ratios in the algae averaged 9.5:1. On the basis of areal rates of nutrient remineralization and the oxygen budget, most of the net community pro-

duction from April to August could be assigned to the open water rather than to the littoral region. Littoral production processes are relatively isolated from the open water in this small, sheltered lake during the time of thermal stratification. (Author's abstract)
W87-07950

CHANGES OF PHOSPHORUS AND NITROGEN CONCENTRATION AND OF PHYTOPLANKTON IN ENRICHED LAKE ENCLOSURES,
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
V. Istvanovics, L. Voros, S. Herodek, L. G. Toth, and I. Tatrai.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 798-811, July 1986. 7 fig, 2 tab, 38 ref.

Descriptors: *Limnology, *Phosphorus, *Nitrogen, *Phytoplankton, *Hypertrophic lakes, *Aquatic productivity, *Nitrogen cycle, Nitrates, Accumulation, Phosphates, Lakes, Simulation, Nutrients, Biomass, Aquatic plants, Plankton, Substrates, Sediments, Lake sediments, Trophic level, Productivity, Denitrification, Eutrophication, Algae, Bacteria, Aquatic bacteria.

Enclosures isolating 17 cu m water with the underlying sediments in the mesotrophic area of Lake Balaton were used to simulate the main processes taking place in its hypertrophic area. In an enclosure with both P and N added, the production and the biomass of phytoplankton increased immediately. Algae rapidly took up the added nutrients, transporting a third of the loadings from the water to the sediments and supplying a large amount of organic substrate for denitrification. As a result of N loss from the system, Aphanizomenon flos-aquae formed a second bloom. In an enclosure with only N added, the production and the biomass of algae remained similar to those in the open water. Nitrate accumulated in the water for a long time. In an enclosure with only P added, the algal production and biomass showed a moderate increase, followed by an outburst of A. flos-aquae. Phosphate accumulated in the water during the first part of the experiment and was used up during the second. (Author's abstract)
W87-07951

NUMERICAL ANALYSIS OF HYPOLIMNETIC NITROGEN AND PHOSPHORUS TRANSFORMATIONS IN LAKE ROTOITI, NEW ZEALAND: A GEOTHERMALLY INFLUENCED LAKE,
Montana State Univ., Bozeman. Dept. of Biology.
J. C. Priscu, R. H. Spigel, M. M. Gibbs, and M. T. Downes.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 812-831, July 1986. 7 fig, 3 tab, 53 ref.

Descriptors: *Limnology, *Numerical analysis, *Hypolimnion, *Nitrogen, *Phosphorus, *New Zealand, *Geothermal studies, *Cycling nutrients, *Lakes, *Model studies, Chlorophyll, Oxygen, Particulate matter, Thermal stratification, Dissolved oxygen, Decomposition, Ammonium, Seasonal variation, Anaerobic conditions, Epilimnion, Nutrients, Mathematical studies.

Measurements of chlorophyll, oxygen, and particulate and dissolved forms of nitrogen and phosphorus made over a year were used in a one-dimensional diffusion model to calculate rates of generation or loss of these substances in the hypolimnion of Lake Rotoiti, New Zealand. During summer stratification, the hypolimnion was always a sink for chlorophyll, particulate nitrogen (PN), particulate phosphorus (PP), and dissolved oxygen. The order of decomposition was chlorophyll > PP > PN. The hypolimnion was a source for NH4(+) and dissolved reactive phosphorus (DRP), whereas dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) showed no distinct seasonal trends. N2O reached 8,800% of air saturation just before the hypolimnion became anaerobic; at the time, the hypolimnetic N2O pool comprised about 13% of the total dissolved inorganic nitrogen pool. Diffusion of dissolved inorganic nitrogen (DIN) and DRP from the hypolimnion to the epilimnion could increase mean epilimnetic concentrations during summer stratification by 0.10 mg DRP/cu m/d and 0.34 mg DIN/cu m/d. The ratio of DIN:DRP supplied to the epilimnion was 3.4 (by weight), which would exacerbate DIN deficiency in this lake. (Author's abstract)
W87-07952

MEASUREMENT OF BACTERIAL CHLOROPHYLL AND ALGAL CHLOROPHYLL A IN NATURAL WATERS,
Marine Biological Lab., Woods Hole, MA.
For primary bibliographic entry see Field 7B.
W87-07955

FLOW-MEASURING SYSTEM FOR USE IN SMALL LAKES,
Duke Univ., Durham, NC. Dept. of Zoology.
For primary bibliographic entry see Field 7B.
W87-07956

FERROUS IRON AND PHOTOTROPHY AS ALTERNATIVE SINKS FOR SULPHIDE IN THE ANOXIC HYPOLIMNIA OF TWO ADJACENT LAKES,
Freshwater Biological Association, Ambleside (England).
W. Davison, and B. J. Finlay.
Journal of Ecology JECOAB, Vol. 74, No. 3, p 663-673, September 1986. 5 fig, 36 ref.

Descriptors: *Limnology, *Iron, *Sulfides, *Sulfur cycle, *Anaerobic conditions, *Hypolimnion, *Lakes, *Photosynthetic bacteria, Particulate matter, Ions, Light penetration, Bacteria, Aquatic bacteria, Sedimentation, Ecology, Chemical reactions, Geochemistry, Biochemistry, Oxidation, Biological oxidation, Epilimnion, Chemical properties, Photosynthesis, Ponds, Metabolism, Solubility.

Ferrous iron and sulfide accumulated to similar concentrations in the anoxic hypolimnia of two adjacent lakes. Solubility products indicated that the waters were saturated with, and concentrations of these ions presumably controlled by, particulate iron sulfide. However, in the shallower lake (< 4 m), light penetrated to the hypolimnion and supported photosynthetic bacteria that oxidized sulfide to sulfate. Iron sulfide therefore failed to form in the water column, but was formed in the sediment from the high concentrations of dissolved components in the pore water. In the deeper lake, light was attenuated within the oxidized epilimnion. This precluded phototrophic oxidation of sulfide and allowed simple chemical formation and sedimentation of FeS. These results illustrate a natural competition between geochemical and biological processes of sulfide removal in biologically productive freshwater lakes. (Author's abstract)
W87-07962

EXAMINATION OF THE GENERALITY OF EUTROPHICATION MODELS,
Royal Danish School of Pharmacy, Copenhagen.
For primary bibliographic entry see Field 5C.
W87-07968

CONTAMINANT UPTAKE BY FISH AND THE POTENTIAL FOR TRANSFER TO HUMANS MODELLED OVER TIME,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 5B.
W87-07969

SPECIES COMPETITIVE ABILITY AND POSITION ALONG A NATURAL STRESS DISTURBANCE GRADIENT,
Ottawa Univ. (Ontario). Dept. of Biology.
S. D. Wilson, and P. A. Keddy.
Ecology ECOLAR, Vol. 67, No. 5, p 1236-1242, October 1986. 3 fig, 2 tab, 45 ref.

Descriptors: *Limnology, *Competition, *Nutrients, *Stress, *Aquatic ecosystems, *Aquatic plants, *Ecology, *Lakes, Prediction, Habitats, Waves, Ontario, Biomass, Organic matter, Sediments, Particle size, Ecological distribution, Shores, Lake shores, Ecosystems, Disturbance.

The distributions of seven plant species were measured along a gradient of exposure to wave action on the shore of Axe Lake, Ontario to test the prediction that plant species that grow in undisturbed, nutrient-rich habitats tend to have higher competitive abilities than those in disturbed or nutrient-poor habitats. The seven species were Eriocaulon septangulare, Rhynchospora fusca, Hypericum ellipticum, Juncus pelocarpus, Lysimachia terrestris, Dulichium arundinaceum, and Drosera intermedia. The exposure gradient incorporates disturbance (through the removal of plant biomass) and stress (through the creation of a gradient in sediment organic content, nutrient concentrations, and fine particle sizes). Species distributions on the exposure gradient were quantified by determining the mean sediment organic content of the quadrats containing each species. Competitive abilities were measured as relative increase in dry mass per plant in a field experiment in which species were grown together in all pairwise combinations. Species had significantly heterogeneous competitive abilities ($P < .01$). Species found on exposed, nutrient-poor shores (e.g., E. septangulare) had low competitive abilities, while those growing on sheltered, nutrient-rich shores (e.g., D. arundinaceum) had high competitive abilities. Competitive ability was significantly correlated with mean position on the exposure gradient. (Author's abstract)
W87-07970

PRODUCTION, PREDATION, AND DECOMPOSITION IN A LOW-SALINITY HIBISCUS MARSH,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
For primary bibliographic entry see Field 2L.
W87-07976

LIMNETIC HERBIVORY: EFFECTS ON PHYTOPLANKTON POPULATIONS AND PRIMARY PRODUCTION,
Notre Dame Univ., IN. Dept. of Biological Sciences.
A. M. Bergquist, and S. R. Carpenter.
Ecology ECOLAR, Vol. 67, No. 5, p 1351-1360, October 1986. 8 fig, 3 tab, 34 ref. NSF Grant BSR 83 08918.

Descriptors: *Population dynamics, *Primary productivity, *Chlorophyll a, *Phytoplankton, *Grazing, *Enzymes, *Carbon cycle, *Lakes, Plankton, Aquatic plants, Algae, Ecosystems, Zooplankton, Nutrients, Michigan, Biomass, Carbon, Cycling nutrients, Standing crops, Ecology.

Population-level and ecosystem-level responses of phytoplankton to grazing by zooplankton were determined in nutrient-enriched and unenriched enclosures in Peter Lake, Michigan. Species-specific net growth rates, chlorophyll a, primary production (PPR), and alkaline phosphatase activity (APA) were determined for each of three size categories of phytoplankton: < 22 microns, 22-75 microns, > 75 microns. Thirteen of 16 dominant algal taxa were nutrient-limited. Zooplankton reduced APA, an indicator of nutrient deficiency. Growth rates of grazed, nutrient-limited algae (< 30 microns) increased at low levels of zooplankton biomass, but decreased at higher biomass levels. Growth rates of larger (> 30 microns) nutrient-limited algae increased or did not change as zooplankton biomass increased. These species-specific responses resulted in four- to five-fold changes in chlorophyll concentration and PPR. Overall, the stimulatory effect of nutrient regeneration by zooplankton overrode losses due to grazing, and caused net increases in phytoplankton biomass and productivity. (Author's abstract)
W87-07977

GROWTH AND PRODUCTION OF A STREAM STONEFLY: INFLUENCES OF DIET AND TEMPERATURE,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
B. W. Sweeney, and R. L. Vannote.

Ecology ECOLAR, Vol. 67, No. 5, p 1396-1410, October 1986. 8 fig, 9 tab, 25 ref. DOE Contract DE-AC02-79EV 10239, NSF Grant DAR 78-18589.

Descriptors: *Limnology, *Stoneflies, *Diet, *Temperature effects, *Productivity, *Growth rates, *Streams, *Aquatic insects, Percolation, Forests, Deciduous forests, Litter, Organic matter, Seeps, Leaves, Trees, Growth stages, Larval growth stage, Mortality, Food, Habitats, Growth, Seasonal variations, Temperature, Life history studies, Beech trees.

Larval growth, mortality, and productivity, as well as the timing of emergence and the size of adults, were assessed in the naturally occurring populations of the stonefly Soyedina carolinensis, and the differences related to differences in available food and in temperature among study sites. During the first year, larvae fed only on sugar maple or chestnut oak leaves exhibited the same rate and magnitude of growth as larvae fed natural, mixed-leaf diets, although larval growth rates and adult size seemed lower on other monospecific diets. There was no correlation between larval growth rate and productivity on a given diet. During the second year, most sites that had been previously supplied with single-species leaf diets were provided with sugar maple leaves only to evaluate site-to-site differences in habitat quality. The amount of variation in larval growth rate and adult size among sites having a common diet was equal to or greater than among-site variation during the previous year. The results suggest that diet exerts some influence on the seasonal pattern and magnitude of larval growth. However, site-to-site differences in the seasonal pattern and magnitude of temperatures exhibited the best correlation with observed differences in larval growth and adult size. (Author's abstract)
W87-07978

PERSISTENT BLOOM OF THE DIATOM RHIZOSOLENIA ERIENSIS (SMITH) AND OTHER CHANGES ASSOCIATED WITH DECREASES IN HEAVY METAL CONTAMINATION IN AN OLIGOTROPHIC LAKE, VANCOUVER ISLAND,

Ministry of Environment, Nanaimo (British Columbia). Waste Management Branch.
For primary bibliographic entry see Field 5C.
W87-07979

SPECTRAL ABSORPTION AND SCATTERING PROPERTIES OF DISSOLVED AND PARTICULATE COMPONENTS IN RELATION TO THE UNDERWATER LIGHT FIELD OF SOME TROPICAL AUSTRALIAN FRESHWATERS,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. T. O. Kirk, and P. A. Tyler.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 573-583, October 1986. 2 fig, 3 tab, 15 ref.

Descriptors: *Limnology, *Spectral analysis, *Dissolved solids, *Particulate matter, *Light penetration, *Light quality, *Tropic zone, *Australia, *Water analysis, *Billabongs, Climatic zones, Optical properties, Physical properties, Absorption, Photosynthesis, Radiation, Pigments, Turbidity, Humic acids, Seasonal variation, Light intensity.

The inherent optical properties (scattering coefficients and absorption coefficients across the photosynthetic waveband) are presented from diverse tropical water bodies (billabongs) in the Alligator Rivers Region of northern Australia. The data are then used to interpret observed characteristics of the underwater light field as exemplified by the spectral distribution, and overall rate of attenuation, of photosynthetically available radiation (PAR). Attenuation of PAR, especially in the blue waveband, is caused primarily by intense light absorption by both soluble and particulate yellow-brown humic pigments in the water. It is estimated that, in six moderately turbid billabongs, light scattering increased attenuation by an average of 58% above that attributable to absorption alone, whereas in a highly turbid billabong the increase was 111%. A distinguishing feature of the optical character of these billabongs, compared with previously studied water bodies in southern Australia, is the great contribution to light absorption made by the particulate humic material. (Author's abstract)
W87-08030

SPATIAL VARIATION OF WATER TEMPERATURE CHARACTERISTICS AND BEHAVIOUR IN A DEVON RIVER SYSTEM,

Exeter Univ. (England). Dept. of Geography.
B. W. Webb, and D. E. Walling.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 585-608, October 1986. 11 fig, 4 tab, 36 ref.

Descriptors: *Limnology, *Spatial distribution, *Water temperature, *Hydrology, *River systems, *Devon, *Seasonal variation, *Monitoring, Distribution, Temperature, Physical properties, Rivers, Vegetation, Runoff, Channels, Reservoirs, Elevation, Diurnal distribution, Trout, Fish, Thermal properties, Growth, Temperature effects.

The results of five years of continuous monitoring of river water temperatures at 17 stations within the Exe basin, Devon (U.K.) are presented and discussed. Systematic spatial variation in mean annual water temperature was evident and was strongly related to topographic elevation. Deviations from this relationship reflect local influences of vegetation shading, runoff source, and channel character. Considerable spatial variation in temperature extremes was also apparent, and the Exe basin differs from several other British river systems in exhibiting highest peak temperatures at downstream sites on the mainstream. Discharge from Wimbleball Reservoir exerted a significant influence on annual maxima and minima. A clear seasonal cycle characterized all stations and was objectively defined by second-order harmonic functions which varied in amplitude and phase across the study area. Marked spatial variability in the magnitude and timing of diurnal temperature fluctuations, in temperature duration curves, and in accumulated temperatures was also recorded. The implications of the spatial variation in thermal regime for the growth of brown trout is discussed. (Author's abstract)
W87-08031

OCCURRENCE OF METACERCARIAE OF THE TREMATODE, CYATHOCOTYLE OPACA (WISNIEWSKI), IN THREE SPECIES OF LAKE-DWELLING LEECHES,

Liverpool Univ. (England). Dept. of Zoology.
S. M. Spelling, and J. O. Young.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 609-613, October 1986. 2 fig, 10 ref.

Descriptors: *Limnology, *Trematodes, *Leeches, *Seasonal variation, *Parasitism, *Growth stages, *Lakes, *Distribution patterns, Annelids, Density, Population density, Mortality, Life history studies, Life cycle, Eutrophic lakes, Biomass, Ecology, Infection, Parasites, Ducks, Waterfowl.

The leeches Erpobdella octoculata, Glossiphonia complanata, and Helobdella stagnalis were collected at monthly intervals over a two-year period from a eutrophic English lake and examined for the presence of metacercariae of the trematode Cyathocotyle opaca. Only one specimen each of H. stagnalis and G. complanata harbored the parasite. Seasonal changes in prevalence levels in E. octoculata were similar for each of the three cohorts identified during the study period. Values were low in young leeches recruited in the autumn, rose slowly until the following spring, and then increased more rapidly until the autumn, when the cohort died out. Mean intensity and relative density showed similar patterns of seasonal change to that of prevalence. There was no evidence of parasite-induced mortality in E. octoculata. Attainment of sexual maturity did not differ between infected and uninfected leeches. (Author's abstract)
W87-08032

EFFECTS OF TEMPERATURE AND PHOTOPERIOD ON LIFE HISTORY PARAMETERS OF DAPHNIA MAGNA (CRUSTACEA: CLADOCERA),

Helsinki Univ. (Finland). Dept. of Genetics.
H. Korpelainen.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 615-620, October 1986. 4 tab, 29 ref.

Descriptors: *Limnology, *Temperature effects, *Life history studies, *Daphnia, *Photoperiodism, *Growth, *Survival, *Reproduction, Crustaceans, Temperature, Ecology, Environment, Aquatic environment, Aquatic animals, Aquatic life, Distribution, Diurnal distribution, Seasonal variation, Analysis of variance.

The life history responses to constant conditions of temperature and photoperiod of two common and three rare Daphnia magna clones were investigated, and intraspecific variation in the genes controlling growth, survivorship, and reproduction was observed. Rearing temperature had a significant effect on growth and survivorship and on all reproductive parameters measured (generation time, intrinsic rate of increase, and male production), while photoperiod significantly influenced only survivorship and male production. The maximum proportion of male offspring was produced at a low temperature (14 C) and at a mid-range photoperiod (L:D 16:8). The likely mechanism whereby clones with different life histories are maintained in the population is discussed. It is suggested that variation in biotic selective components (predation, competition, and food availability) is an essential factor causing shifts in the relative rates of increase among Daphnia clones. (Author's abstract)
W87-08033

SPATIAL AND TEMPORAL VARIATION IN THE MACROINVERTEBRATE FAUNA OF STREAMS OF THE NORTHERN JARRAH FOREST, WESTERN AUSTRALIA: FUNCTIONAL ORGANIZATION,

Western Australia Univ., Nedlands. Centre for Water Research.
S. E. Bunn.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 621-631, October 1986. 1 fig, 8 tab, 34 ref.

Descriptors: *Limnology, *Model studies, *Spatial distribution, *Temporal distribution, *Aquatic animals, *Macroinvertebrates, *Streams, *Australia, *Forests, Distribution, Ecological distribution, Distribution patterns, Aquatic life, Invertebrates, Prediction, Species composition, Density, Population density, Organic matter, Food habits, Food chains, Predation, Seasonal variation, River systems, Environment, Aquatic environment, Riffles.

Spatial and temporal changes in functional organization of the invertebrate community of streams of the northern jarrah forest (Western Australia) were examined in the light of predictions of the river continuum concept. The composition of the fauna was largely as predicted for forested headwater streams, with detritivores, principally collectors, dominating the fauna. Although shredders are generally considered to be codominant in such streams, they were not abundant in the riffle areas sampled in this study. Some of the observed temporal changes in the composition of functional feeding groups agreed with those predicted by the generalized model. The abundance and richness of collectors were higher during the summer than winter, whereas the converse was true for filterers. This corresponded to the presumed availability of deposit and suspended fine-particulate organic matter during summer and winter, respectively. Scrapers and predators showed no consistent temporal pattern among sites, although the density of the latter was highly correlated with the density of other invertebrates, particularly collectors. Temporal changes in the abundance and richness of shredders were not synchronized with the marked summer input of coarse-particulate organic matter. The possible reasons for this are discussed along with the role of shredders in Australian stream systems. (Author's abstract)
W87-08034

SUSPENDED BACTERIA IN CALCAREOUS AND ACID HEADSTREAMS: ABUNDANCE,

HETEROTROPHIC ACTIVITY AND DOWNSTREAM CHANGE,
Hull Univ. (England). Dept. of Plant Biology.
C. A. Rimes, and R. Goulder.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 633-651, October 1986. 10 fig, 6 tab, 38 ref.

Descriptors: *Limnology, *Aquatic bacteria, *Suspension, *Heterotrophic bacteria, *Population density, *Headwaters, *Downstream, *Acid streams, *Calcareous streams, Density, Bacteria, Streams, Glucose, Accumulation, Bioaccumulation, Trophic level, Mineralization, Microscopy, Electron microscopy, Microscopic analysis, Water analysis, Kinetics, Acidity, Acidic water, Chemical properties, Hydrogen ion concentration.

Concentrations of total suspended bacteria and heterotrophic activity were determined at intervals along four high-trophic-status calcareous headstreams in Great Britain. Mean concentration of suspended bacteria was marginally greater in the calcareous streams, while turnover rate and turnover rate per bacterium were substantially greater. Heterotrophic activity was greater in the calcareous streams. Mean cell volume of suspended bacteria, measured by electron microscopy, was found to be greater in the calcareous streams. In the calcareous streams, the concentration of total bacteria and turnover rate usually increased substantially, in a straight-line relationship, with distance downstream from the source. In the acid streams, such downstream increase was less usual, the rate of increase per unit length of stream was less, curvilinear relationships were more frequent, and on some occasions downstream decrease was observed. The calcareous and acid streams thus formed two distinct groups on the basis of heterotrophic activity, cell volume, and rate of downstream increase of suspended bacteria. This division was not necessarily caused solely by difference in pH, but might be due to the combined effects of the many environmental variables which change in parallel with pH. (Author's abstract)
W87-08035

SPECIES SEGREGATION DURING PREDATOR EVASION IN CYPRINID FISH SHOALS,
University Coll. of North Wales, Bangor. School of Animal Biology.
J. R. Allan, and T. J. Pitcher.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 653-659, October 1986. 4 fig, 1 tab, 27 ref.

Descriptors: *Limnology, *Fish behavior, *Species composition, *Predation, *Shoals, *Distribution patterns, *Ecology, Fish, Distribution.

When a predator attacks a mixed-species group, individual prey are faced with a conflict between retaining the advantages of large group size and the disadvantages of remaining among aliens. Simulated attacks with a model predator were made upon mixed and single species shoals of three cyprinid species under semi-natural conditions in a fluvarium to investigate how this conflict is resolved in fish shoals. Measurements of elective group size, neighbor identity and distance, and encounters within and between species revealed behavior which sorted fish into species at the onset of predator attack. A control experiment demonstrated the same effect for fish of matched size. The value to the individual of segregative behavior in response to predator threat is discussed. It is concluded that shoaling fish constantly re-appraise the shifting costs and benefits of group living. A continual flux in elective group size and composition is observed in these cyprinids under undisturbed conditions. The immediate shift in the cost-benefit balance that occurs when a predator is detected is rapidly tracked by the fishes' subsequent behavior. (Author's abstract)
W87-08036

GEOCHEMICAL ASPECTS OF AQUEOUS IRON, PHOSPHORUS AND DISSOLVED ORGANIC CARBON IN THE HUMIC LAKE TJEUKEMEER, THE NETHERLANDS,
Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
H. De Haan, and T. De Boer.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 661-672, October 1986. 4 fig, 6 tab, 42 ref.

Descriptors: *Limnology, *Geochemistry, *Iron, *Phosphorus, *Dissolved solids, *Organic carbon, *Humic acids, *Netherlands, *Lakes, *Polders, Carbon, Chemical properties, Reservoirs, Peat, Fulvic acids, Filtration, Ultrafiltration, Chelation, Colloids, Seasonal variation, Calcium, Gels.

The geochemistry of the humic Lake Tjeukemeer (Netherlands) was investigated. The main source of P, Fe, and dissolved organic carbon (DOC) in the lake is superfluous water pumped from surrounding peaty polders. Most particulate P is intracellular, but almost all particulate Fe is abiotic. The size and molecular weight of the P, Fe, and DOC (mainly fulvic acids (FA)) were determined by ultrafiltration and Sephadex G-100 gel filtration. Throughout the year, most dissolved P and Fe were in colloids > 35 nm with apparent molecular weights between 30,000 and 150,000. The bulk of FA occurred in particles < 35 nm. Calculating the atomic ratios of P, Fe, and organic C in the different size classes revealed that Fe-FA chelates are a minor species of the Fe pool. Less than 10% of the fulvic acids occurred as Fe-FA chelates. Based on their apparent size and molecular weight, the Fe-FA chelates are colloidal aggregates. About 50% of the dissolved P had the same size as the Fe-FA aggregates. These aggregates were only noticeable in winter when humus-rich polder water was flushed through the lake. During the rest of the year, the dissolved Fe and P consisted mainly of acid-labile inorganic colloids which might have been organically coated. (Author's abstract)
W87-08037

RESOURCE-MEDIATED DEMOGRAPHIC VARIATION DURING THE MIDSUMMER SUCCESSION OF A CLADOCERAN COMMUNITY,
Oklahoma Univ., Kingston. Biological Station.
S. T. Threlkeld.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 673-683, October 1986. 6 fig, 2 tab, 30 ref. NSF Grant DEB 8022163.

Descriptors: *Limnology, *Succession, *Waterfleas, *Lake Texoma, *Aquatic populations, *Population density, *Aquatic environment, *Seasonal variation, Daphnia, Crustaceans, Zooplankton, Plankton, Populations, Animal populations, Lakes, Temperature, Water temperature, Physical properties, Fertility, Life cycle, Growth stages, Growth rates, Phenology, Density, Ecology, Environment, Ecosystems.

The midsummer succession of cladoceran zooplankton in Lake Texoma, OK was examined by demographic characterization of lake populations and a parallel set of life table experiments in which the dominant cladoceran species were raised on naturally-occurring lake phytoplankton at lake temperatures. Individual growth rates of the two Daphnia species and Ceriodaphnia in the life table experiments were significantly lower in mid-July when populations were declining and when the size structure of each population was more dominated by smaller individuals. The reduction in individual growth rates was short-lived; growth rates returned to pre-decline levels by the end of July. Two effects of temporary reductions in individual growth rates when size-specific fecundity and size at maturation are constant are that size structure is temporarily shifted to smaller individuals, and that the potential rate of population growth is reduced because of delays in reproduction. It is concluded that erroneous conclusions about the mechanism of population decline may be reached when individual growth rates vary. (Author's abstract)
W87-08038

INITIAL COLONIZATION OF PERIPHYTON ON NATURAL AND ARTIFICIAL APICES OF MYRIOPHYLLUM HETEROPHYLLUM MICHX,
State Univ. of New York at Binghamton. Dept. of Biological Sciences.
J. O. Morin.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 685-694, October 1986. 2 fig, 6 tab, 15 ref.

Descriptors: *Limnology, *Periphyton, *Myriophyllum, *Colonization, *Algae, *Substrates, *Lakes, *Aquatic plants, *Littoral environment, Macrophytes, Environment, Aquatic environment, Density, Population density, Diatoms, Chrysophyta, Cyanophyta, Chlorophyta, Seasonal variation, Species composition, Ecology, Water depth, Distribution patterns.

The initial colonization of periphyton on natural and artificial apices of Myriophyllum heterophyllum was compared at three depths in the littoral zone of Lake Winnipesaukee, a soft-water New England lake. Apices were sampled after a one-week incubation period, and the periphyton was removed and counted as numbers of organisms per centimeter of stem. Initial colonization on both substrates was characterized by diatoms, particularly small single-celled species, throughout the spring and summer. Blue-green and green algae occurred in low numbers on both substrates during mid-summer, usually forming a greater percentage of the population of the natural apices. Blooms of the green alga Zygnema sp. dominated both substrates in late August. Community composition generally did not differ significantly by depth or substrate on the natural and artificial apices, although total abundance was significantly greater on the natural apices. M. heterophyllum appeared to serve as a neutral substrate in terms of community composition but had a positive effect on the total numbers of algae. (Author's abstract)
W87-08039

FISH COMMUNITIES IN THE PERENNIAL WETLAND OF THE SUDD, SOUTHERN SUDAN,
Severn-Trent Water Authority (England).
P. Hickley, and R. G. Bailey.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 695-709, October 1986. 4 fig, 4 tab, 16 ref.

Descriptors: *Limnology, *Wetlands, *Sudan, *Fish populations, *Species composition, *Species diversity, *Aquatic habitats, *Ecological distribution, Swamps, Sampling, Channels, Lakes, Vegetation, Catfish, Density, Population density, Shallow water, Migration, Fish, Fish behavior, Rivers, Habitats, Environment, Aquatic environment, Growth stages, Juvenile growth stage, Flood plains, Spawning, Cattails.

Fish sampling, chiefly by gill-netting and electric fishing, was conducted in the perennial wetland of the Sudd (southern Sudan). Sixty-two species were recorded including 15 catfishes, 13 characoids, seven cyprinids, seven mormyrids, and seven cichlids. The highest diversity and abundance of fishes was obtained in the shallow lakes which revealed considerable uniformity in population structures. Flowing-water habitats exhibited a similar but restricted fauna. Peak catches in a representative river-lake could be interpreted as the arrival of fish for breeding or their migration through the lake for reproduction elsewhere. The capture of fry or juveniles of many species in fringing or marginal vegetation indicates that the 'permanent' floodplain of the Sudd provides suitable spawning and rearing grounds. Access to the extensive Typha zone was limited, but from available evidence it was inferred that air-breathing fishes, notably Heterotis and Gymnarchus, may penetrate the swamps to reach areas remote from perennial transmission channels. (Author's abstract)
W87-08040

EFFECTS OF FLUCTUATING TEMPERATURE ON MORTALITY, STRESS, AND ENERGY RESERVES OF JUVENILE COHO SALMON,
National Marine Fisheries Service, Kodiak, AK. Northwest and Alaska Fisheries Center.
R. E. Thomas, J. A. Gharrett, M. G. Carls, S. D. Rice, and A. Moles.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 1, p 52-59, January 1986. 3 fig, 1 tab, 27 ref.

Descriptors: *Temperature effects, *Salmon, *Mortality, *Stress, *Energy, *Fish physiology,

*Juvenile growth stage, *Diurnal distribution, Fluctuations, Temperature, Water temperature, Physical properties, Ecological effects, Growth stages, Fish, Animal physiology, Glucose, Liver, Forest management, Logging, Clear-cutting, Alaska, Food habits, Distribution, Metabolism, Blood, Physiological ecology, Tissue analysis.

The effects of fluctuating diel temperature cycles on survival, growth, plasma cortisol and glucose concentrations, liver weight, and liver glycogen of juvenile coho salmon (Oncorhynchus kisutch) were determined. Temperature cycles (10-13, 9-15, 8-17, and 6.5-20 C) were selected to simulate observed temperatures in clear-cuts of southeastern Alaska. Different levels of feeding, including starvation, were used in each test. LT50s were 28 C for age-0 fish (350 mg) and 26 C for age-II fish (22-g presmolts). Cyclic temperatures for 40 d, averaging 11 C daily, did not influence growth of age-0 fish on any food ration as compared to controls held at a constant 11 C. Plasma cortisol and glucose concentrations were significantly greater in fish maintained for 20 d in the 6.5-20 C cycle, but not different in fish in 10-13 and 9-15 C cycles or a constant 11 C. These elevated concentrations may be indicators of long-term stress. Plasma cortisol concentrations were lower in starved fish than in fed fish at all temperature regimes; however, fluctuating temperature did not enhance starvation effects on cortisol levels. Diel temperature cycles did not affect liver weights or liver glycogen concentrations. It is concluded that temporary high temperatures above lethal limits, even if only for 1-2 h, may be more harmful than long-term fluctuating temperatures. (Author's abstract)
W87-08041

CONTAMINATION OF STREAM FISHES WITH CHLORINATED HYDROCARBONS FROM EGGS OF GREAT LAKES SALMON,
Michigan Dept. of Natural Resources, Ann Arbor. Inst. for Fisheries Research.
For primary bibliographic entry see Field 5B.
W87-08042

EFFECTS OF LOW PH ON REPRODUCTION OF RAINBOW TROUT,
Oregon Cooperative Fishery Research Unit, Corvallis.
For primary bibliographic entry see Field 5C.
W87-08043

BACTERIAL GROWTH IN MIXED CULTURES ON DISSOLVED ORGANIC CARBON FROM HUMIC AND CLEAR WATERS,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.). Abt. Mikrobenoekologie.
L. J. Tranvik, and M. G. Hofle.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 3, p 482-488, March 1987. 5 fig, 3 tab, 45 ref.

Descriptors: *Limnology, *Bacteria, *Dissolved organic carbon, *Bacterial growth, *Mixed cultures, *Limnology, *Humic lakes, *Biomass, Growth rate, Bioaccumulation, Phenols, Sugars, Nutrients, Cultures, Natural waters, Carbon, Microbiology.

Interactions between bacterial assemblages and dissolved organic carbon (DOC) from different sources were investigated. Mixed batch cultures were set up with water from a humic and clear-water lake by a 1:20 dilution of the bacterial assemblage (1.0 micron of prefiltered lake water) with natural medium (sterile filtered lake water) in all four possible combinations of the two waters and their bacterial assemblages. Bacterial numbers and biomass, DOC, thymidine incorporation, ATP, and uptake of glucose and phenol were followed in these cultures. Growth curves and exponential growth rates were similar in all cultures, regardless of inoculum or medium. However, bacterial biomass produced was double in cultures based on water from the humic lake. The fraction of DOC consumed by heterotrophic bacterial during growth was in the same range, 15 to 22% of the total DOC pool, in all cultures. Bacterial growth efficiency, calculated from bacterial biomass produced and DOC consumed, was in the order of 20%. Glucose uptake reached a peak during exponential growth in all cultures. Phenol uptake was insignificant in the cultures based on the clear-water medium, but occurred in humic medium cultures after exponential growth. The similarity in the carbon budgets of all cultures indicated that the source of the bacterial assemblage did not have a significant effect on the overall carbon flux. However, fluxes of specific organic compounds differed, as reflected by glucose and phenol uptake, depending on the nature of the DOC and the bacterial assemblage. (Author's abstract)
W87-08045

SEASONAL OCCURRENCE OF CAMPYLOBACTER SPP. IN SURFACE WATERS AND THEIR CORRELATION WITH STANDARD INDICATOR BACTERIA,
Central Washington Univ., Ellensburg. Dept. of Biological Sciences.
A. M. Carter, R. E. Pacha, G. W. Clark, and E. A. Williams.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 3, p 523-526, March 1987. 3 tab, 19 ref. EPA Cooperative agreement CR-810827.

Descriptors: *Bioindicators, *Limnology, *Seasonal variation, *Campylobacter, *Natural waters, *Lakes, *Ponds, *Streams, *Bacteria, Population density, Coliforms, Physical properties, Isolation, Washington, Microbiology.

Campylobacter jejuni, Campylobacter coli, and a Campylobacter-like organism were isolated from a number of natural water sources in central Washington, including ponds, lakes, and small mountain streams at elevations ranging from 1,460 to 5,400 feet (ca. 445 to 1,646 m) above sea level. At the two sites where extensive sampling was done, the bacteria were recovered throughout the year. Generally, the recovery rates were highest in the fall and winter months and lowest during the spring and summer months. Campylobacter density did not show significant correlation with microbiological (plate counts of fecal and total coliforms, fecal streptococci, and heterotrophic bacteria) or physical (water temperature, pH, and conductivity) parameters. (Author's abstract)
W87-08046

SEED BANK OF A FRESHWATER TIDAL WETLAND: TURNOVER AND RELATIONSHIP TO VEGETATION CHANGE,
Rider Coll., Lawrenceville, NJ. Dept. of Biology.
M. A. Leck, and R. L. Simpson.
American Journal of Botany AJBOAA, Vol. 74, No. 3, p 360-370, March 1987. 1 fig, 7 tab, 34 ref.

Descriptors: *Limnology, *Wetlands, *Tide lands, *Seed banks, *Turnover, *Species composition, *Vegetational succession, Prediction, Plants, Germination, Seeds.

Depletion during spring germination (turnover), longevity, and successional relationships were studied at High Marsh (HM), Cattail (CT), and Shrub Forest (SF) sites in a freshwater tidal wetland over three years. There was significant seasonal reduction in size and composition of seed banks from all sites. Turnover was greatest in HM surface (0-2 cm) samples where 20 x more seeds germinated in March than in June. In CT and SF samples turnover was considerably less. Magnitude (34-97%) was related to species composition and factors affecting field germination. Decrease in density with depth (0-10 cm) was log-linear in March samples. Except for SF 30-32 cm, few seeds and species were found at 8-10, 15-17, or 30-32 cm. Three seed bank strategies were distinguished: (a) complete turnover (Type II, sensu Thompson and Grime 1979), (b) high turnover with some reserve (Type III), and (c) large long-term seed reserve (Type IV). Longevity of many species appeared to be restricted; 31-56% at each site were present only in surface samples, and 29-52% germinated only in March samples. Although some species were important at all three sites, the seed bank composition of each was distinct, and was related to vegetation composition at each site. Because the bulk of the seed bank at each site resembles its site vegetation more than that of another site, it is not possible to predict succession. (Author's abstract)
W87-08049

SPIROGYRA SPECIES AND ACCOMPANYING ALGAE FROM DUNE WATERS IN THE NETHERLANDS,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
J. Simons.
Acta Bot. Neerl. ABNRAN, Vol. 36, No. 1, p 13-31, February 1987. 6 fig, 9 tab, 34 ref.

Descriptors: *Ponds, *Limnology, *Algae, *Spirogyra, *Dunes, *Carbonates, *Species composition, *Population dynamics, Seasonal variation, Netherlands, Spores, Nutrients, Alkalinity.

A survey is given of the occurrence of filamentous algae from dune pools situated in the calcium carbonate-rich dune area at Oostvoorne and Egmond-Castricum as well as the calcium carbonate-poor Wadden area at Terschelling. Spirogyra and Oedogonium were important and often dominant components at these sites and were represented by at least 35 and 20 species respectively. Accompanying species belonged to Zygnema, Mougeotia, Bulbochaete, Microspora and Tribonema. In several pools Chara was dominant. Mass occurrence of filamentous algae was frequently observed. The seasonal dynamics of the components in floating mats were described. Periodicity phenomena of components and individual Spirogyra and Oedogonium species were studied. A peak in spore production of Spirogyra was situated in the second half of May and the first half of June. Based on physico-chemical data, the water of most of the investigated pools can be characterized as mesotrophic freshwater with a moderate or high amount of calcium and bicarbonate. Water quality differences between Terschelling (low alkalinity) and Egmond-Castricum/Oostvoorne (high alkalinity) were reflected in their species composition. Most of the species from the dune pools are also known from other more nutrient-rich habitats in The Netherlands, but there are differences in quantities and combination of species. (Author's abstract)
W87-08051

VEGETATIONAL SUCCESSION, MANAGEMENT AND HYDROLOGY IN A BROOKLAND (THE NETHERLANDS),
Groningen Rijksuniversiteit (Netherlands). Dept. of Plant Ecology.
J. P. Bakker, C. Brouwer, L. Van Den Hof, and A. Jansen.
Acta Bot. Neerl. ABNRAN, Vol. 36, No. 1, p 39-58, February 1987. 5 fig, 7 tab, 26 ref.

Descriptors: *Limnology, *Vegetational succession, *Hydrology, *Brooklands, *Groundwater, *Aquifers, Nutrients, Base flow, Rainfall, Minerals, Plants, Nature reserves.

The relation is discussed between management, hydrology and the resulting vegetational succession during the period between 1975 and 1980 in a characteristic lower course of a Drenthian brook. The hay-making without fertilizer application could eventually lead to a gradient from Caricion-curto nigrae at the valley flank to Magnocaricion adjacent to the brook. These communities are related to mesotrophic mineral-rich groundwater seeping from a deep aquifer, groundwater with a short residence time in the soil with rainwater characteristics, and an intermediate groundwater type. The actual vegetational succession reveals an increase of the nutrient-rich communities of Glyceria maxima and Carex acuta/Carex aquatilis typicum and of the nutrient-poor community of Carex nigra, whereas mesotrophic Magnocaricion communities decreased. This is probably caused by a deep land consolidation ditch adjacent to the nature reserve diverting the base flow. Mineral-rich groundwater, therefore, is replaced by mineral-poor rainwater on the one hand and by nutrient-rich flood water on the other hand. Management practices inside a nature reserve can thus be seriously countered by qualitative hydrological changes outside a reserve even with slightly higher groundwater tables. (Author's abstract)

W87-08052

ISOLATION OF AN EXTREMELY THERMOPHILIC CHEMOORGANOTROPHIC ANAEROBE SIMILAR TO DICTYOGLOMUS THERMOPHILUM FROM NEW ZEALAND HOT SPRINGS,
Waikato Univ., Hamilton (New Zealand). Dept. of Biological Sciences.
B. K. Patel, H. W. Morgan, J. Wiegel, and R. M. Daniel.
Archives of Microbiology AMICCW, Vol. 147, No. 1, p 21-24, February 1987. 1 fig, 2 tab, 16 ref.
DOE Grant DE-FG09-84-ER13248.

Descriptors: *Limnology, *Hot springs, *Thermophilic bacteria, *New Zealand, *Thermal springs, *Dictyoglomus, *Anaerobic bacteria, Isolation, Bacteria, Sugars, Bacterial growth, DNA.

A strain similar to Dictyoglomus thermophilum, isolated from a New Zealand hot spring, is described. This strictly anaerobic, Gram-negative, non-motile and non-sporulating bacterium usually exists as long thin filaments of 5 to 25 micron by 0.35 to 0.45 micron. Rotund bodies are commonly observed. Thin sections of the cells revealed a two-layered cell wall. The optimum temperature and pH for growth was 70 C and 7.0 and 7.5 respectively. No growth was observed at 40 C and 85 C or at pH 4.5 to pH 9.0. The organism fermented glucose, maltose, amnnose, xylose, lactose, cellobiose, galactose and sucrose and produced acetate as the major end-product with significant amounts of lactate, H2 and CO2 and only traces of ethanol. The doubling time on glucose was 10 h. The DNA base composition was 29.5% guanine plus cytosine as determined by the thermal denaturation method. Growth was inhibited by penicillin, tetracycline and chloramphenicol indicating that the organism was a eubacterium. These features are in common with the newly described species Dictyoglomus thermophilum to which the New Zealand isolate belongs. (Author's abstract)
W87-08053

OBLIGATELY PHOTOTROPHIC CHLOROFLEXUS: PRIMARY PRODUCTION IN ANAEROBIC HOT SPRING MICROBIAL MATS,
Indiana Univ. at Bloomington. Dept. of Biology.
S. J. Giovannoni, N. P. Revsbech, D. M. Ward, and R. W. Castenholz.
Archives of Microbiology AMICCW, Vol. 147, No. 1, p 80-87, February 1987. 6 fig, 4 tab, 34 ref.
NSF Grant DEB-8023341.

Descriptors: *Hot springs, *Thermal springs, *Thermophilic bacteria, *Phototrophic bacteria, *Limnology, *Chloroflexus, *Microbiology, *Isotope studies, *Light quality, *Sulfides, Isolation, Bacteria, Nutrients, Cycling nutrients.

Microbial mats which lack cyanobacteria occur at 50 to 65 C in the sulfide-containing Mammoth Springs of Yellowstone National Park. The principal organisms within these mats are filamentous bacteria which resemble Chloroflexus aurantiacus. The incorporation of (14C)-HCO3(-) into mat material depended upon both light and sulfide, and was not inhibited when complete natural light was replaced with far-red and infra-red radiation. (14C)-acetate was incorporated in a light-dependent reaction which was stimulated by, but did not require, sulfide. In situ experiments with microelectrodes demonstrated net sulfide uptake by the mat in the light, and net sulfide production by the mat in the dark, suggesting the operation of a sulfur cycle. Filamentous phototrophic bacteria isolated from the mat were incapable of sustained growth in the presence of O2. Simultaneous exposure of cultures to light and O2 caused degradation of bacteriochlorophyll c. The stimulation of light-dependent (14C)-HCO3(-)-uptake by sulfide was more pronounced in these isolates than in strains of Chloroflexus aurantiacus. (Author's abstract)
W87-08054

EFFECTS OF FISH AND PH ON THE DISTRIBUTION AND ABUNDANCE OF BACKSWIMMERS (HEMIPTERA: NOTONECTIDAE),
Canadian Wildlife Service, Ottawa (Ontario).
B. E. Bendell.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 12, p 2696-2699, December 1986. 1 fig, 2 tab, 19 ref.

Descriptors: *Limnology, *Backswimmers, *Lakes, *Hydrogen ion concentration, *Predation, *Population dynamics, Fish, Species composition, Toxicology, Hemiptera.

Backswimmer populations were sampled across a range of pH in lakes with and without fish. Irrespective of pH, backswimmers were abundant in lakes without fish, and usually absent or scarce in lakes with fish. The observed distribution of Notonecta spp. and Buenos spp. among lakes does not appear to reflect competitive interactions among species, but is best explained by the presence or absence of fish predators and, in the case of Notonecta borealis, the poor dispersal ability of the species. To separate the effects of fish loss from other pH-related effects, the relationship between pH and backswimmer population densities was examined within the group of fishless lakes. Differences in population densities of Buenoa spp. among fishless lakes were found to be related to pH. However, the form of the relationship was best described by a curvilinear function that was not suggestive of a toxicological relationship. (Author's abstract)
W87-08060

LIFE HISTORIES, PRODUCTION, AND MICRODISTRIBUTION OF TWO CADDISFLIES (TRICHOPTERA) IN A ROCKY MOUNTAIN STREAM,
Alberta Univ., Edmonton. Dept. of Zoology.
G. A. Ogilvie, and H. F. Clifford.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 12, p 2706-2716, December 1986. 10 fig, 6 tab, 26 ref.

Descriptors: *Life history studies, *Caddisflies, *Streams, *Limnology, *Rocky Mountains, *Reproduction, Larvae, Eggs, Pupation, Instars, Emergence, Food habits, Distribution, Diatoms, Production.

The results of a 2-year study of the caddisflies Oligophelbodes zelti (Limnephilidae) and Neothremma alicia (Uenoidae) in a first-order Rocky Mountain stream of southern Alberta are reported. The Oligophlebodes population had a univoltine cycle: eggs were oviposited in July and August and hatched in about 20 days, and the larvae grew rapidly during the remainder of the ice-free season. Larvae overwintered in the fourth larval instar and molted to the fifth instar in the following spring. Pupation occurred in June, and adults started emerging in mid-July. Annual production for the O. zelti population was 116 mg/sq m/year. The Neothremma population had a 2-year cycle. Eggs apparently hatched after freeze-up. Larvae overwintered in the second instar. Most of the population achieved the third instar by the following July and the fourth instar by August, and spent the second winter in either the fourth or fifth instar. There was about a 3-week prepupal stage the following July and then emergence in July and August. Annual production for the N. alicia population was 103 mg/sq m/year. Oligophlebodes zelti and N. alicia larvae fed mainly on fine particulate organic matter and diatoms. Both O. zelti and N. alicia larvae were found on rocks only in fast water areas, but the two populations did not inhabit the same riffles. The riffles inhabited by O. zelti were wider with lower slopes and water velocities than riffles dominated by N. alicia larvae. Correlation analysis, using several parameters, indicated that total periphyton of the rocks might be a major factor accounting for O. zelti's distribution. The microdistribution of the N. alicia population was not correlated with any food source. (Author's abstract)
W87-08061

COMPETITIVE DEVELOPMENT OF THIOCAPSA ROSEOPERSICINA AND CHLOROBIUM PHAEBACTEROIDES IN LAKE KINNERET,
Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Hydrologie.
W. Eckert, T. Frevert, T. Bergstein-Ben Dan, and B. Z. Cavari.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 12, p 917-921, December 1986. 6 fig, 2 tab, 19 ref.

Descriptors: *Limnolgoy, *Eutrophication, *Chlorobium, *Thiocapsa, *Lake Kinneret, *Light intensity, *Algal growth, Nutrients, Photosynthesis, Sulfides, Lakes, Algae, Growth.

The beginning of the bloom of Chlorobium phaeobacteroides in Lake Kinneret is accompanied by the occurrence of cells of Thiocapsa roseopersicina, which subsequently disappear. It was found that Thiocapsa requires relatively high light intensities (50-100 micro E/sq m/s) for growth which proved to be higher than that for Chlorobium. Acetate played an important role in the growth of Thiocapsa only when the organisms were exposed to light intensities which were not optimal for photosynthesis. Optimum total sulfide concentrations for growth of Thiocapsa were found to be in the range of 1.3 mM. Considering the differential uptake of the reduced sulfur components H2S and HS(-), a preference for HS(-) is suggested. It seems further likely that H2S inhibits growth at concentrations above 1 mM, independent of the pH. Compared with Chlorobium, favorable conditions for Thiocapsa at the beginning of the bloom period are due to low in situ concentrations of H2S, which prevent rapid development of Chlorobium. (Author's abstract)
W87-08065

EVALUATING THE WETLAND RESOURCE,
Silsoe Coll. (England).
For primary bibliographic entry see Field 4C.
W87-08084

ELEMENTAL COMPOSITION OF JUNCUS BULBOSUS IN AN ACIDIFIED FRESHWATER RESERVOIR,
Turku Univ. (Finland). Dept. of Biology.
K. Aulio.
Environmental Pollution, Vol. 44, No. 1, p 1-11, 1987. 4 fig, 3 tab, 22 ref.

Descriptors: *Acidic water, *Nutrients, *Trace elements, *Limnology, *Juncus, *Reservoirs, Tissue analysis, Submerged plants, Finland, Heavy metals, Transport, Bioindicators, Metals.

Concentrations of the major nutrients (N, P, Mg, K, Na) and trace elements (Fe, Mn, Zn) were determined in tissues of the submerged aquatic plant Juncus bulbosus L. collected from the acidified Freshwater Reservoir of Uusikaupunki in SW Finland. The heavy metals showed markedly elevated concentrations, mainly due to the enhanced solubility and availability of metals in the reservoir receiving acidic, sulfate-rich discharges from the catchment area. Tissue analyses of J. bulbosus could be used to reveal specific transport patterns in the reservoir. Multivariate principal components ordination of the data of the elemental analyses demonstrated local differences in the availability of metals. (Author's abstract)
W87-08106

TEST OF FLUCTUATING ASYMMETRY IN BLUEGILLS (LEPOMIS MACROCHIRUS RAFINESQUE) AS A MEASURE OF PH-RELATED STRESS,
National Fisheries Contaminant Research Center, Columbia, MO.
J. G. Wiener, and P. J. Rago.
Environmental Pollution, Vol. 44, No. 1, p 27-36, 1987. 2 tab, 26 ref.

Descriptors: *Bioindicators, *Fluctuating asymmetry, *Bluegill, *Water pollution effects, *Acidic water, *Limnology, *Lakes, *Calcium, *Fish physiology, Wisconsin, Fish, Stress, Gills.

Fluctuating asymmetry of bilateral anatomical characters, previously proposed as an indicator of stress induced by agents affecting the calcium metabolism of fishes, was measured in bluegills (Lepo-

mis macrochirus) from eleven Wisconsin lakes. The fluctuating asymmetries of three meristic characters-numbers of pored lateral line scales, pectoral finrays and gill rakers on the outer arch-were either unrelated or only marginally related to either lake pH or waterborne calcium concentration. The asymmetry variance of gill raker counts was negatively correlated with both lake pH and waterborne calcium concentration; however, the overall asymmetry mean of gill raker counts in bluegills from five low pH lakes only slightly exceeded that in bluegills from six lakes with circumneutral pH. Fluctuating asymmetry in adult fishes was judged to be insensitive as a potential measure of pH-related stress. (Author's abstract)
W87-08108

EFFECTIVENESS OF BLUE TILAPIA AS A WEED CONTROL AGENT IN PONDS,
Langston Univ., OK.
For primary bibliographic entry see Field 4A.
W87-08113

PSYCHROPHILES, PSYCHROTROPHS, AND GLUCOSE MINERALIZATION IN A LAKE WITH SEASONAL TEMPERATURE FLUCTUATIONS,
Laurentian Univ., Sudbury (Ontario). Dept. of Biology.
I. A. Shklar-McAuley, and G. D. Ferroni.
Journal of General and Applied Microbiology JGAMA9, Vol. 32, No. 5, p 383-391, 1986. 1 fig, 3 tab, 14 ref.

Descriptors: *Biodegradation, *Bacteria, *Psychrophiles, *Psychrotrophs, *Glucose, *Heterotrophic bacteria, *Mineralization, *Sediment-water interface, *Bethel Lake, *Limnology, Ontario, Sugars, Bacteria, Incubation, Isolation, Temperature effects, Turnover, Substrates.

During an 18-month period, heterotrophic bacteria were quantified and the rates of glucose mineralization were measured in samples from the sediment-water interface of Bethel Lake, a small productive lake located in the city of Sudbury, Ontario, Canada. Among three incubation temperatures 2 C, 18 C, and 37 C, the highest bacterial counts were obtained consistently at 18 C. With incubation at 2 C the highest counts occurred when the water temperature in the lake was 10 C or lower, and psychrophilic bacteria were recovered only at such times. Most of the 2 C and 18 C isolates were psychrotrophs. Some of the 18 C isolates were incapable of growth at either 2 C or 37 C, the extreme recovery temperatures examined. Turnover times and heterotrophic potentials for the substrate of interest were calculable for seven of the eight mineralization experiments. Substrate turnover occurred more quickly and the potential for glucose mineralization was always greater at the higher test temperature, for a given sampling. Cold water temperatures did not preclude glucose mineralization. (Author's abstract)
W87-08128

STRATIGRAPHY AND GENESIS OF THE LAKE SIXTEEN PEATLAND, NORTHERN MICHIGAN,
Michigan Univ., Ann Arbor. Dept. of Botany.
R. P. Futyma, and N. G. Miller.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 12, p 3008-3019, December 1986. 9 fig, 55 ref.

Descriptors: *Paleohydrology, *Paleolimnology, *Lake Sixteen, *Peatlands, *Stratigraphy, *Limnology, *Alkaline lakes, *Sediments, *Radioactive dating, History, Lakes, Gyttja, Sedge, Fens, Bogs, Vegetation patterns, Swamps.

The Lake Sixteen peatland is a 400-ha mire consisting principally of low-shrub (Chamaedaphne) bog and lesser areas of tree-covered (Picea-Larix) bog and sedge fen adjacent to a 55-ha alkaline lake. The sediments consist of the following super-imposed deposits: gyttja, sedge peat, and Sphagnum-ericad-sedge peat. Near the edges of the peatland, highly humified, sometimes woody peat is present as the basal layer instead of gyttja. Radiocarbon-dated pollen stratigraphies from the lake and four sites in the peatland have elucidated the temporal relationships of the various sediments units and the developmental history of the peatland. During the mid-Holocene, probably in response to a change to cooler, moister climate, early Lake Sixteen underwent an expansion resulting in the deposition of gyttja over an increasingly larger area. About 3000 years BP, a sedge fen developed on the edge of the lake. Low-shrub bog replaced the sedge vegetation as the fen mat expanded into the lake. Swamping of bordering forests also allowed expansion of bog vegetation outward from the basin. Hydrological changes accompanying peat accumulation probably promoted vegetational changes within the peatland and the centrifugal spread of bog vegetation through swamping. (Author's abstract)
W87-08133

COLUMBIA RIVER ESTUARY DATA DEVELOPMENT PROGRAM (CREDDP). DYNAMICS OF THE COLUMBIA RIVER ESTUARINE ECOSYSTEM. VOLUME 1,
Columbia River Estuary Study Taskforce, Astoria, OR.
For primary bibliographic entry see Field 2L.
W87-08206

STORAGE PROJECTION FOR RESERVOIR SYSTEMS: A CASE STUDY OF THE HIGHLAND LAKES,
Texas Univ. at Austin. Center for Research in Water Resources.
S. K. Vaugh, and D. R. Maidment.
Technical Report No. CRWR 216, September 1985. 160 p, 55 fig, 21 tab, 25 ref, 3 append.

Descriptors: *Reservoir storage, *Case studies, *Highland Lakes, *Texas, *Colorado River, *Hydrologic budget, Probability distribution, Statistical studies, Reservoirs, Lake evaporation.

Two methods were studied for estimating the probability distribution of future storage in a reservoir system: transient analysis and Gould's probability matrix method. The theoretical basis and computational procedure of each method has been presented and both have been applied to the six-reservoir Highland Lakes System located on the Lower Colorado River near Austin, Texas. A significant portion of this study involved the analysis of reservoir inflows, water supply diversions, and net lake surface evaporation which are the three major components of the water balance in the Highland Lakes. The magnitude and monthly distribution of annual water supply diversions for municipal use, crop irrigation, and cooling pond make-up at power generation facilities was estimated from historical records. Irrigation diversion were considered in somewhat greater detail as they annually comprise approximately 83% of the total volume of water supplied by the LCRA Highland Lakes. The methodologies and data sources employed in the compilation and computation of historical reservoir inflows and net evaporation were described in detail. The results obtained in the application of transient analysis and Gould's method to the Highland Lakes System are presented. These results include: (1) projected probability distributions of system storage up to six years into the future based on current water demands and three different initial storage scenarios; (2) a tabulated envelope of uncertainty which provides the system management agency with a measure of the 'worst case' and 'best case' response of system storage to a specified water demand; (3) transient analysis plots illustrating probability of exceedance vs. active storage percentage for Lakes Buchanan and Travis and the entire system based alternatively on current water demand, elimination of the second rice crop, and variable irrigation demand ranging from 50% to 150% of the current level; (4) an example hydrologic frequency analysis based on the Pearson Type III distribution fitted by transient analysis; (5) time reliability vs. storage percentage plots computed during the application of Gould's method considering both average demand and second crop elimination. Finally, the storage projections generated by transient analysis and Gould's method were compared to one another and to projections made by transient analysis using randomly shuffled historical hydrologic data sets. (Lantz-PTT)
W87-08225

SEDIMENT REMOVAL,
Pacific Northwest Environmental Research Lab., Corvallis, OR.
For primary bibliographic entry see Field 2J.
W87-08226

HIGHLAND LAKES: AN EVALUATION OF THE AVAILABLE BIOLOGICAL DATA,
Texas Univ. at Austin. Center for Research in Water Resources.
J. M. Patek, and N. E. Armstrong.
Center for Research in Water Resources Technical Report No. CRWR-197, August 1982. 162 p, 3 fig, 11 tab, 4 append.

Descriptors: *Highland Lakes, *Data collections, *Biological properties, *Colorado River, *Texas, *Limnology, Lakes, Lake morphology, Water supply.

A complex interaction of a number of physical, chemical, and biological factors occurs in a lake or reservoir. Management of such a large scale resource demands the projections of future trends of water quality changes within the system. The need to predict these future trends requires a comprehensive knowledge of the phenomena involved, as well as an extensive data base for the system of concern. Little is known about these phenomena in southwestern reservoirs. This lack of data in a state with rapidly escalating water requirements urgently necessitates limnological studies on Texas impoundments for quality management. The Highland Lake system is a series of reservoirs constructed on the Colorado River in central Texas. They constitute an immensely valuable resource because they: are situated near several metropolitan areas and, consequently, serve as recreational centers; serve as the water supply for several nearby cities, function in sediment control, flood control, and conservation as well as generating hydroelectric power. The purpose of this work was to collect and to assess the available biological and related data for this system of seven reservoirs. A series of tables and figures have been developed to depict this information in several ways, each intended to facilitate the accesability of this data. It is also the purpose of this report to assess the reliability and applicability of the data relative to point and non-point source pollutant modeling and eutrophication oriented studies. (Lantz-PTT)
W87-08237

PERENNIAL N2 SUPERSATURATION IN AN ANTARCTIC LAKE,
National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
R. A. Wharton, C. P. McKay, R. L. Mancinelli, and G. M. Simmons.
Nature NATUAS, Vol. 325, No. 6102, p 343-345, January 1987. 1 tab, 14 ref. NSF Grant DPP-8416340 and NASA Grant NCA2-2.

Descriptors: *Dissolved gases, *Dissolved oxygen, *Antarctica, *Nitrogen supersaturation, *Limnology, Nitrogen, Oxygen, Lake Hoare, Lake ice, Ice cover, Lakes.

The dry valleys of southern Victoria Land in Antarctica contain several closed basins in which perenially ice-covered lakes are found. One of the most unusual features of these lakes is the occurrence of high oxygen concentrations in the water column; values ranging from slightly more than saturation to more than four times saturation have been reported. Recently, we considered a bulk O2 budget for Lake Hoare, Antarctica, which led us to suggest that biological processes alone were not sufficient to explain the observed elevated oxygen levels. Consequently, there must be a non-biological source of O2. We suggested that this source results from the exclusion of O2 during the freezing of aerated meltstream water at the bottom of the ice cover, and predicted that this physical mechanism should also enhance the other atmospheric gases. Here we report the results of a study which, for the first time, documents the supersaturation of nitrogen in a lake. Dissolved N2 levels of

145% and 163 % were determined from samples taken just below the ice cover and at a depth of 12m, respectively. The relative importance of biological and abiological sources is reflected in the ratio of N2 concentration to O2 concentration. In Lake Hoare this ratio was 1.20 at the ice/water interface and 1.05 at 12m; considerably different from the ratio in equilibrium with air (approximately 1.8). Based on these results, we have determined that about half of the net O2 production in the lake is the result of biological processes. (Authors' abstract)
W87-08255

BATTLE OF THE BOG,
For primary bibliographic entry see Field 4C.
W87-08256

THOUSAND YEARS OF DEATH,
King's Coll., London (England). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W87-08257

DETERMINATION OF EXCHANGEABLE INORGANIC NITROGEN SPECIES IN WETLAND SOILS,
Canberra Coll. of Advanced Education, Belconnen (Australia). Water Research Centre.
For primary bibliographic entry see Field 5D.
W87-08258

FISH HEAD ACETYLCHOLINESTERASE ACTIVITY AFTER AERIAL APPLICATION OF TEMEPHOS IN TWO RIVERS IN BURKINA FASO, WEST AFRICA,
Institute of Aquatic Biology, Achimota (Ghana).
For primary bibliographic entry see Field 5C.
W87-08259

EVALUATION OF GROWTH AND PRODUCTION OF JARAQUIS (SEMAPROCHILODUS SPP) IN A TERRA FIRMA STREAM IMPOUNDMENT IN THE ENVIRONS OF MANAUS, AMAZONAS (AVALIACAO DO CRESCIMENTO E DA PRODUCAO DE JARAQUIS (SEMAPROCHILODUS SPP), EM DE IGARAPE DE TERRA FIRME NOS ARREDORES DE MANAUS, AMAZONAS),
Instituto Nacional de Pesquisas da Amazonia, Manaus (Brazil).
E. de Resende, E. Filho, A. M. Paixao, and A. S. Filho.
Acta Amazonica, Vol. 15, No. 1/2, p 19-36, March-June 1985. 6 fig, 3 tab, 17 ref.

Descriptors: *Impaired water use, *Limnology, *Aquaculture, *Fish hatcheries, *Water reuse, Reservoirs, Brazil, Earth dams, Farm wastes, Detritus.

The potential growth and production of 'jaraquis', Semaprochilodus spp, in a terra firma stream impoundment with chemically poor waters was evaluated. The waste water from pig sties was used as a source of food and organic manure. During the experimental period of 383 days at a stocking density of 1 fish/ sq m the production obtained was 1277 kg/ha. The fish in the impoundment presented similar growth to those from lakes and rivers. The 'jaraquis' are promising candidates for fish culture in the Amazon. (Author's abstract)
W87-08274

RIVERS OF THE AMAZON BASIN II. THE TRIBUTARIES OF THE RIO BRANCO (RIOS DA BACIA AMAZONICA II. OS AFLUENTES DO RIO BRANCO),
Instituto Nacional de Pesquisas da Amazonia, Manaus (Brazil).
U. M. Santos, S. R. B. Bringel, M. N. G. Ribeiro, and M. N. P. da Silva.
Acta Amazonica, Vol. 15, No. 1/2, p 147-156, March-June 1985. 1 fig, 2 tab, 14 ref.

Descriptors: *Limnology, *Water quality, *Water chemistry, *Data collections, *Physicochemical properties, *River systems, Agriculture, Brazil, Chemical analysis, Heavy metals, Nitrogen, Phosphorus, Humic acids, Hydrogen ion concentration, Conductivity.

Water samples were collected from 13 tributaries in the Rio Branco river basin and analyzed for: pH, conductivity, Ca, Mg, Na, K, Fe (soluble, complexed, and total), Mn, total P, Kjeldahl N, organic N, ammonium, color, humic material, Cl, Si, and total Al. The results were analyzed statistically using a correlation matrix. Several of these tributaries had relatively low concentrations of mineral salts and according to the results of the RADAM BRASIL project (vol. 8, 1975) would be classified as electrolyte poor. Three of the rivers (the Uraricoera, Mucajai, and the Branco) have fertile flood plains (varzeas), the largest being that in the lower region of the Rio Branco, which could be better exploited to support subsistence agriculture in the territory of Roraima. (Author's abstract)
W87-08276

PREDATORY BEHAVIOR OF THE ALPINE TRITON (TRITURUS ALPESTRIS) IN AN ALPINE LAKE (2 125M, FRENCH ALPS) (ACTIVITE PREDATRICE DU TRITON ALPESTRE (TRITURUS ALPESTRIS) DANS UN LAC ALPIN (2,125 M, ALPES FRANCAISES)),
Lyon-1 Univ., Villeurbanne (France). Lab. d'Ecophysiologie.
J. M. Chacornac, and P. Joly.
Acta Oecologica, Oecologia Generalum, Vol. 6, No. 2, p 93-103, 1985. 5 fig, 3 tab, 16 ref.

Descriptors: *Limnology, *Predation, *Mountain lakes, *Fish diets, *Alpine regions, *Food chains, Oligotrophic lakes, Fish, Lakes, Insects, Benthic fauna, Spawning.

The predatory activity of a population of Triturus alpestris in an alpine lake (Lake Creux aux Marmottes) is studied by means of stomach sampling on living animals. The temporal dimension is given by three-hourly samplings, during two nycthermal cycles in summer. The diet is characterized by capture on the one hand of exogenous prey, which are snapped at the surface of the water, and on the other hand of prey of very low energetic value (Chydoridae). These facts can be viewed as reactions to the low biogenic capacity of the environment. The temporal distribution of the activity shows a plasticity which makes possible the foraging of temporary resources. The theoretical implications of such observations are discussed. (Author's abstract)
W87-08282

DESCRIPTION OF A LOTIC ENVIRONMENT (THE FRENCH UPPER RHONE) USING DISCRIMINANT ANALYSIS ON QUALITATIVE VARIABLES (APPROCHE PAR L'ANALYSE DISCRIMINANTE SUR VARIABLES QUALITATIVES D'UN MILIEU LOTIQUE, LE HAUT RHONE FRANCAIS),
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Ecologie.
For primary bibliographic entry see Field 6G.
W87-08283

SPECIES DIVERSITY AND STRUCTURE OF MEIOBENTHIC COMMUNITIES IN A LAGOON ECOSYSTEMS (DIVERSITE SPECIFIQUE ET STRUCTURE DES PEUPLEMENTS MEIOBENTHIQUES D'UN ECOSYSTEME LAGUNAIRE),
Bordeaux-1 Univ., Talence (France). Inst. de Biologie Marine.
J. Castel.
Acta Oecologica, Oecologia Generalum, Vol. 6, No. 4, p 395-412, 1985. 3 fig, 2 tab, 75 ref.

Descriptors: *Limnology, *Species diversity, *Stochastic models, *Lagoons, *Model studies, Eutrophic lakes, Aquatic ecosystems, Biological communities.

The definition of a community structure is complex but can be approached synthetically using an index of diversity. In the classical theories, biological interactions are supposed to increase the diversity by increasing the complexity of the system. This hypothesis is tested on the meiobenthic communities living in a lagoon ecosystem on the Atlantic coast (Arcachon Bay). Using a neutral model which eliminates the influence of biological interactions, the diversity was no different from what was predicted. In spite of the limitations of using such models, a number of pieces of evidence show that the meiobenthic communities living in littoral lagoon ecosystems are mostly controlled by physical factors. In certain conditions, however, macrobenthos can modify significantly the community structure of meiobenthos either by predation or by bioperturbation. From these results, the determinism of diversity variations is discussed. It is concluded that the environmental heterogeneity hypothesis is the only diversity hypothesis supported by convincing evidence in meiobenthic communities from eutrophic ecosystems. The determinism of the organization and dynamics of the communities is based on the etho-physiological properties of the individual species. (Author's abstract)
W87-08284

DISSEMINATION STRATEGIES OF TREMATODE CERCARIAE IN A MARINE LITTORAL ECOSYSTEM (STRATEGIES DE DISSEMINATION DES CERCAIRES DE TREMATODES DANS UN ECOSYSTEME MARIN LITTORAL),
Saint-Jerome Univ., Marseille (France). Lab. de Zoologie et Biologie Marines.
P. Bartoli, and C. Combes.
Acta Oecologica, Oecologia Generalum, Vol. 7, No. 2, p 101-114, 1986. 13 fig, 18 ref.

Descriptors: *Limnology, *Trematodes, *Lagoons, *Migration, *Parasites, Mollusks, Benthos, Benthic fauna, Mediterranean Sea, Adaptation.

In an inshore marine ecosystem taken as a model, the behavior of the Trematodes' cercariae, all produced in benthic Mollusks, is closely adapted to the ecology of their targets. In all, twelve species of Trematodes are examined (all from Brusc Lagoon, near Toulon, Western Mediterranean Sea). The species of cercariae whose development has to continue on benthic organisms do not spread on their own or do so slightly on the sea bed; the species which develop on fish living in open water spread markedly in the vertical plane, coming as close to the surface as their targets' natural habitat justifies; the species specific to fish dependent upon the upper strata go upwards and stay in the close vicinity of the air-water interface; finally, the species which are parasites on Crustacea living in a subaerial environment cling to the interface and infestation occurs either because the Crustacean periodically crosses the interface or because water droplets containing the cercariae are projected onto the Crustacea. These different strategies belong to 'favorizing' mechanisms represented here by the cercariae's adaptative behavior. In the chosen model the corollary of the existence of targets living in very diverse strata is a series of behavioral patterns adapted to a conquest of regions more and more distant from the benthic environment which allows advantage to be taken of the whole of the ecosystem, and of regions even beyond its limits. (Author's abstract)
W87-08285

GRAPHICAL APPROACH TO PRINCIPAL COMPONENT ANALYSIS: UTILIZATION IN HYDROBIOLOGY (APPROCHE GRAPHIQUE DE L'ANALYSE EN COMPOSANTES PRINCIPALES NORMEE: UTILISATION EN HYDROBIOLOGIE),
Lyon-1 Univ., Villeurbanne (France).
For primary bibliographic entry see Field 7C.
W87-08286

SURVIVAL OF PATHOGENIC BACTERIA IN VARIOUS FRESHWATER SEDIMENTS,
Texas Univ. at Dallas, Richardson. Graduate Program in Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-08288

NITRIFYING BACTERIA IN WASTEWATER RESERVOIRS,

Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
For primary bibliographic entry see Field 5D.
W87-08294

EXPLANATIONS FOR THE ACCLIMATION PERIOD PRECEDING THE MINERALIZATION OF ORGANIC CHEMICALS IN AQUATIC ENVIRONMENTS,
For primary bibliographic entry see Field 5B.
W87-08297

PROPERTIES OF DESULFOVIBRIO CARBINOLICUS SP. NOV. AND OTHER SULFATE-REDUCING BACTERIA ISOLATED FROM AN ANAEROBIC-PURIFICATION PLANT,
Groningen Rijksuniversiteit (Netherlands). Dept. of Microbiology.
For primary bibliographic entry see Field 5D.
W87-08298

DISTRIBUTION OF IRON-OXIDIZING BACTERIA IN THE NORDIC URANIUM TAILINGS DEPOSIT, ELLIOT LAKE, ONTARIO, CANADA,
Canada Centre for Mineral and Energy Technology, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W87-08299

COMPUTER BASED CULTURING SYSTEM FOR MEASURING THE PHOTOSYNTHETIC RESPONSE OF PHYTOPLANKTON TO A FLUCTUATING ENVIRONMENT,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
For primary bibliographic entry see Field 7B.
W87-08319

KINETICS OF NUTRIENT UPTAKE AND GROWTH IN PHYTOPLANKTON,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
F. M. M. Morel.
Journal of Phycology JPYLAJ, Vol. 23, No. 1, p 137-150, March 1987. 10 fig, 4 tab, 27 ref. NSF Grant OCE 831 7532 and ONR Grant N00014-80-C-0273.

Descriptors: *Limnology, *Mathematical equations, *Kinetics, *Nutrients, *Bioaccumulation, *Phytoplankton growth, *Algae, *Acclimatization, Phytoplankton, Growth, Saturation, Limiting nutrients.

Microscopic algae can grow rapidly in natural waters that are extremely low in essential macro and micro nutrients. Yet, their nutrient uptake systems exhibit only mediocre nutrient affinities, the saturation constants being often 10-1000 times the (estimated) ambient concentrations. The large difference which exists between the saturation constants for growth (K sub mu) and short term uptake (K sub rho) are due to the acclimation capabilities of the organisms. Over the acclimation range, K sub mu to K sub rho, the algae can maintain maximum growth rate by modulating both their internal nutrient quotas (Q) and their maximum short term nutrient uptake rates (rho sub max) in response to variations in external nutrient concentrations. The commonly assumed hyperbolic relationships for steady growth and uptake (viz 'chemostat theory') are coherent with a hyperbolic expression for short term uptake including a variable maximum (rho sub max). The ratio of the saturation constants for growth and uptake is then directly related to the extreme in quotas and maximum uptake rates: K sub mu/K sub rho = Q sub min/Q sub max times (lo rho sub max/hi rho sub max). This result is applicable even when the exact hyperbolic laws are not. Published data on Fe, Mn, P and N limitation in algae are generally in accord with the theory and demonstrate a wider acclimation range for trace than for major nutrients. (Author's abstract)
W87-08321

ROLE OF DIATOMS IN STROMATOLITE GROWTH: TWO EXAMPLES FROM MODERN FRESHWATER SETTINGS,
Texas Univ. at Austin. Dept. of Zoology.
B. M. Winsborough, and S. Golubic.
Journal of Phycology JPYLAJ, Vol. 23, No. 1, p 195-201, March 1987. 14 fig, 25 ref.

Descriptors: *Stromatolites, *Limnology, *Diatoms, *Stromatolite growth, *Eukaryotes, *Calcite precipitation, Ions, Minerals, Carbonates, Polysaccharides, Growth.

Some modern laminated and calcified stromatolitic structures are partially or completely formed by eukaryotes. Diatom populations in freshwater environments with elevated ionic concentrations contribute to calcite precipitation, and the formation of distinctive mineral-rich stromatolitic laminae. Two types of stromatolite-forming diatom populations were observed. In the first example, in stromatolites growing on a quarry ledge near Laegerdorf, North Germany, calcite crystals with biogenic imprints form around polysaccharide stalks of the diatom Gomphonema olivaceum var. calcarea (Cleve) Cleve-Euler. These individually precipitated crystals eventually become cemented together in layers, forming rigid, laminated stromatolitic deposits which drape over the quarry ledge. In the second example, in stromatolites forming in a shallow stream near Cuatro Cienegas, Coahuila, Mexico, diatomaceous laminae also form by the accumulation of carbonate particles in a matrix of diatoms and their extracellular polysaccharide products. These laminae become thick enough to drape over individual stromatolite heads. The diatoms responsible for these deposits are Amphora aff. A. katii Selva, Nitzchia denticula Grun., and six other species. At Cuatro Cienegas, in addition to the diatomaceous laminae, carbonate-rich cyanobacterial layers, dominated by two cyanobacterial species with different fabrics and porosities, are also present and contribute substantially to the growth of the stromatolites. In both the Laegerdorf and Cuatro Cienegas examples, entire stromatolites or thick laminations on stromatolites are built by a small number of diatom species which produce copious amounts of extracellular stalk, gel, and sheath material, a property they share with cyanobacterial stromatolite builders. (Author's abstract)
W87-08322

PATTERNS OF DISTRIBUTION OF DIATOM ASSEMBLAGES ALONG ENVIRONMENTAL GRADIENTS IN THE SEVERN RIVER ESTUARY, CHESAPEAKE BAY, MARYLAND,
Dickinson Coll., Carlisle, PA. Dept. of Geology and Environmental Sciences.
For primary bibliographic entry see Field 2L.
W87-08323

EFFECT OF PH ON MICROBIAL DEGRADATION OF LEAF LITTER IN SEVEN STREAMS OF THE ENGLISH LAKE DISTRICT,
Freshwater Biological Association, Ambleside (England).
A.-C. Chamier.
Oecologia OECOBX, Vol. 71, No. 4, p 491-500, March 1987. 9 fig, 5 tab, 42 ref.

Descriptors: *Limnology, *Microbial degradation, *Leaves, *Litter, *Streams, *Hydrogen ion concentration, Water chemistry, Vegetation, Decay rates, Colonization, Microbiological studies.

Rates of degradation of alder, oak and grass leaf packs with associated microbial populations were measured in seven streams pH 6.8 - 4.9. Streams were chosen from upland and lowland sites of the same river for contrasts in pH, water chemistry and riparian vegetation. The most important factor governing rates of degradation is the physical and chemical nature of the leaf material. At pH 6.8 rates of degradation, 'k', and microbial colonization were higher than at pH < or = 5.5: 'k' on alder x6; on oak x2; on grass x2. At lowland sites, pH 6.8, higher decay rates were associated with high levels of microbial colonization including 14 spp of aquatic hyphomycete fungi - regardless of riparian vegetation. Decay rates were similar at upland sites, pH 6.8 and 6.6, involving high levels of colonization by fewer fungal species and fewer bacteria - regardless of riparian vegetation - though grass was barely degraded at upland sites of any pH. At pH < or = 5.5, slow decay rates were associated with low levels of microbial colonization and few fungal species. Largest microbial populations at low pH associated with riparian trees did not lead to markedly increased decay rates. Factors of water chemistry at low pH appear to inhibit microbial metabolism. The implications of these findings for stream invertebrates active in the winter is discussed. (Author's abstract)
W87-08324

NUTRIENT ENRICHMENT AND EUTROPHICATION OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5C.
W87-08360

SUPERSATURATION OF NITROGEN GAS CAUSED BY ARTIFICAL AERATION IN RESERVOIRS,
Limnological Associates, Kaneohe, HI.
A. W. Fast, and R. G. Hulquist.
Available from the National Technical Information Service, Springfield, Va 22161, as ADA-123129. Price codes: A07 in paper copy; and A01 in microfiche. Technical Report E-82-9, September 1982. Army Engineer Waterways Experiment Station, Vicksburg, MS. 136 p, 38 fig, 5 tab, 34 ref, 2 append. DOA Contract No. DACW39-79-M-2666.

Descriptors: *Aeration, *Nitrogen, *Destratification, *Lake restoration, Mixing, Stratification, Water quality control, Reservoirs, Water resources development.

Eleven reservoirs, ten of which were artificially destratified by air injection, were surveyed for their dissolved nitrogen gas content. No problems with nitrogen supersaturation within a reservoir were observed; however, in some cases, downstream releases from intermediate or deep waters could possibly cause fish mortality in the receiving stream. The most important factors causing excessive nitrogen saturations during artificial aeration, seem to be: degree of thermal destratification, absolute depth of air injection, air injection at intermediate depth, and air density in the bubble plume. (Halterman-PTT)
W87-08410

STUDIES ON THE BACILLUS-POPULATION OF THE NW LITTORAL ZONE OF THE LAKE BALATON (HUNGARY),
Eoetvoes Lorand Univ., Budapest (Hungary). Dept. of Microbiology.
Z. Lango.
Archiv fuer Hydrobiologie AHYBA4, Vol. 108, No. 4, p 449-464, February 1987. 1 fig, 1 tab, 22 ref.

Descriptors: *Limnology, *Species composition, Lake Balaton, *Littoral zone, *Bacillus, *Data collections, Bacteria, Lakes, Numerical analysis, Eutrophication, Computers.

The results of a computer aided comparative numerical analysis carried out on a total of 113 selected representative Bacillus strains isolated from waterlogged detritus (foerna), drift- and open water-habitats, plus from epilittoral terrestrial soils, as well as 20 authentic mostly typical strains of 18 recognized species of Bacillus have revealed that in the NW littoral zone of Lake Balaton, B. megaterium was the absolutely predominant species among bacilli, both at terrestrial and semiaquatic sampling sites. Although the large B. megaterium population of this area was taxonomically complex, being composed of typical forms and different varieties of the species, one particular variety, denominated by us as B. megaterium var. litoralis var. nov. constituted the overwhelming majority of its members. B. cereus, B. subtilis, B. pumilus and B. licheniformis proved to be further, but quantitatively subordinate coinhabitants of the region studied. (Author's abstract)

W87-08511

SULFATE REDUCTION IN A COASTAL LAKE DURING SUMMER STRATIFICATION,
Odense Univ. (Denmark). Biological Inst.
H. S. Jensen, and F. O. Andersen.
Archiv fuer Hydrobiologie AHYBA4, Vol. 108, No. 4, p 465-481, February 1987. 6 fig, 2 tab, 40 ref.

Descriptors: *Limnology, *Sulfates, *Thermal stratification, *Coastal lakes, *Sediments, Sulfur bacteria, Mineralization, Lakes, Organic matter, Anaerobic processes, Saline water intrusion, Lake Holmsjon, Diffusion coefficient, Eddies, Vertical flow.

Patterns of sulfate reduction in water and sediment and pelagic oxygen uptake were studied in Lake Holmsjon, Aland, Finland during summer stratification. Sulfate reduction rate in the anoxic bottom water varied between 2 and 20 micromol sulfate per L per day, while oxygen consumption rates in the epilimnic water varied from 50 to 100 micromol oxygen per L per day. Sulfate reduction in the profundal sediment, measured by the 35SO4(2-) core-injection technique, ranged from 100 to 500 micromol sulfate per L per day. On an areal basis this corresponded to sulfate reduction rates from 31.0 to 43.7 mmol sulfate per sq m per day., which is high compared to other lakes or coastal areas. Sulfate reduction accounted for 25-28% of the total carbon mineralization in the water and sediment column. Coefficients of the vertical eddy diffusion in the bottom water were calculated based on changes over time in the salinity profile. The eddy diffusion coefficient varied between .00043 and .00116 sq cm/s. The sulfate flux towards the sediment was 30.3 to 42.9 mmol per sq m per day, calculated from the sulfate concentration gradients and the eddy diffusion coefficient. Thus, the flux rates agreed well with the sulfate reduction rates measured on sediment cores. (Author's abstract)
W87-08512

EFFECT OF THE COEFFICIENTS OF DISCHARGE ON CILIATE POPULATIONS OF A RUNNING WATER CONTAMINATED BY MUNICIPAL WASTEWATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
F. Stoessel.
Archiv fuer Hydrobiologie AHYBA4, Vol. 108, No. 4, p 483-497, February 1987. 3 fig, 4 tab, 23 ref.

Descriptors: *Limnology, *Flow discharge, *Discharge coefficient, *Protozoa, *Rivers, *Municipal wastewater, Bacteria, Bioindicators, Cassarate River.

Investigations on periphytic ciliates were conducted in the Cassarate (southern Switzerland) at approximately monthly intervals between January 1980 and September 1981. This stream receives municipal wastewater from the densely populated left side of the valley. The ciliates found were compared with the mean velocity of flow and rate of discharge. The data show that sessile peritrichous ciliates are less susceptible to short-term peak effluent loads, and therefore to mechanical stress, than to longer and higher rates of discharge. The latter alters the food spectrum of the ciliates by diluting out, or diminishing sedimentation of degradable organic material and thereby reducing the bacterial suspension. Vagile ciliate populations are far more rapidly decimated by higher rates of discharge. Stable organotrophic populations were observed to provide unfixed ciliates enough protection against washout for a short period of time. Tables give the chemical analysis of the river water (hardness, conductivity, DOC, plus 5 chemical species) and also list the ciliate species found. (Airone-PTT)
W87-08513

ROTIFERS OF THE MAN-MADE SANKARANI LAKE, TRIBUTARY TO THE NIGER RIVER, REPUBLIC MALI, WEST-AFRICA (ZUR RAEDERTIERFAUNA DES SANKARANI-STAUSEES IM EINZUGSGEBIET DES NIGER, REPUBLIK MALI, WESTAFRIKA (ASCHELMINTHES ROTATORIA)),
W. Koste, and W. Tobias.
Archiv fuer Hydrobiologie AHYBA4, Vol. 108, No. 4, p 499-515, February, 1987. 7 fig, 2 tab, 36 ref.

Descriptors: *Limnology, *Plankton, *Rotifers, *Artificial lakes, *Species diversity, Lakes, Dams, Hydroelectric power production, Fisheries.

Rotifers were identified in several plankton samples from the Selingue man-made Lake (river Sankarani, tributary to the Niger River), taken in the years 1982 and 1985. Only 12 taxa out of 54 are of tropical and subtropical origin, the remaining ones are considered to be cosmopolitan. Four Rotifer taxa Collotheca ornata natans (Tschugunoff 1921), Ptygura libera Myers 1934, Testudinella brevicaudata Yamamoto 1951 including the newly described Keratella maliensis n. sp. are new records for the African fauna. The community structure of Rotifers reveals gradual changes which manifest themselves in the increasing diversity. Diversity differences were observed between the roots of the man-made lake and the deeper parts of the water body located closer to the dam-site. In the former location swamp vegetation now fluorishes. All 54 Rotifers are listed in a table which also gives their relative distribution about the lake area. Several of the Rotifers, in particular Keratella, are described in detail. (Airone-PTT)
W87-08514

STUDIES ON SOME ASPECTS OF THE BIOLOGY OF PELLONULA AFZELIUSI (JOHNELS) IN EPE LAGOON, NIGERIA,
Kainji Lake Research Inst., New Bussa (Nigeria).
J. K. Balogun.
Archiv fuer Hydrobiologie AHYBA4, Vol. 108, No. 4, p 517-530, February 1987. 6 fig, 4 tab, 14 ref.

Descriptors: *Limnology, *Fish, *Lagoons, *Spawning, *Coastal lakes, Fish diets, *Epe Lagoon, Fish behavior, Saline water intrusion, Brackish water, Commericial fishing.

The biology of Pellonula afzeliusi (Johnels) occurring in Epe Lagoon (a brackish lake) was investigated. 632 specimens were examined for length frequency distribution, length-weight relationship, condition factor, sex ratio, fecundity, gonad development, gonadotrophic index and stomach contents. Little information has been available on this species in brackish water. The length frequency polygons showed several modes. The least-square fit of the transformed data of length-weight relationship for the combined sexes gave a linear regression equation of log weight = 1.8069 + 2.7328 log length. The condition factors ranged from 1.4 to 1.9 and the values varied with size of fish for both sexes. Females were more abundant than males with a sex ratio of 1 male to 4.9 females. Fecundity estimates for this species ranged from 6,322 to 30,623. The average number of eggs per female was 13,635. The diameters of the eggs varied between 0.25 mm and 0.49 mm. P. afzeliusi put as much as 1.8 to 11.7% of the body weight into the production of eggs. Spawning occurred between November and February. P. afzeliusi fed mainly on copepods, crustacean eggs, ants and insect appendages. (Author's abstract)
W87-08515

DEPTH-DISTRIBUTION AND BIOMASS OF EPILITHIC PERIPHYTON IN LAKE THINGVALLAVATN, ICELAND,
National Center for Hygiene, Food Control and Environmental Protection, Reykjavik (Iceland).
G. S. Jonsson.
Archiv fuer Hydrobiologie AHYBA4, Vol. 108, No. 4, p 531-547, February 1987. 7 fig, 2 tab, 31 ref.

Descriptors: *Lake Thingvallavatn, *Limnology, *Algae, *Subartic zone, Lakes, Seasonal variation, Standing crop, Diatoms, Iceland.

The epilithic algal species at two transects in Lake Thingvallavatn, Iceland, were identified and the vertical distribution of the species described. On the basis of the dominant macroscopic algae the community was divided into three depth zones: the Ulothrix zone, the Nostoc zone, and the Cladophora zone. Total chlorophyll-a was measured to study vertical distribution and the summer variation of standing crop in 1977, 1978 and 1982. In 1982 pure chlorophyll-a and b were also separated quantitatively by a paper chromatographic technique. In 1977 the average standing crop during the summer was estimated to range between 198 (at 0.4 m depth) and 875 (at 4 m) mg total chlorophyll-a per sq m. The standing crop in 1978 and 1982 had the same depth pattern, but the values were much lower than in 1977. (Author's abstract)
W87-08516

EFFECTS OF DECAYING TOXIC BLUE-GREEN ALGAE ON WATER QUALITY - A LABORATORY STUDY,
Norges Veterinaerhoegskole, Oslo. Dept. of Food Hygiene.
For primary bibliographic entry see Field 5C.
W87-08517

MORPHOMETRY AND CHLOROPHYLL PRODUCTION IN EASTHOLSTEIN LAKES (MORPHOMETRIE UND CHLOROPHYLLPRODUKTION VON OSTHOLSTEINISCHEN SEEN),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
M.-E. Meffert, and W.-R. Wulff.
Zeitschrift fuer Wasser- und Abwasser Forschung ZWABAQ, Vol. 20, No. 1, p 13-15, February 1987. 4 fig, 1 tab, 15 ref.

Descriptors: *Limnology, *Chlorophyll, *Eutrophication, *Lake morphology, Secchi disks, Transparency, Photosynthesis, Productivity.

Epilimnetic chlorophyll concentrations and Secchi disk transparencies were investigated from 13 Eastholstein lakes of different trophic levels in April, August and October 1985. The regression shows the trend to reduced Secchi disk transparency with rising chlorophyll concentrations. Below 20 mg/cu m Secchi disk transparencies become increasingly independent from chlorophyll. The relation between mean depth and production, defined by Thienemann, can be demonstrated by the chlorophyll concentration for this lake type. Results are confirmed by 5 annual means of 3 other lakes of the region investigated weekly between 1981 and 1985. (Author's abstract)
W87-08527

INFLUENCE OF AN ECOSYSTEM-LEVEL MANIPULATION ON PREY CONSUMPTION BY A LOTIC DRAGONFLY,
Georgia Univ., Athens. Dept. of Entomology.
J. B. Wallace, T. F. Cuffney, C. C. Lay, and D. Vogel.
Canadian Journal of Zoology CJZOAG, Vol. 65, No. 1, p 35-40, January 1987. 1 fig, 3 tab, 33 ref.

Descriptors: *Limnology, *Predation, *Aquatic insects, *Dragonflies, *Aquatic ecosystems, *Water pollution effects, *Pesticides, Methoxychlor, Streams, Biological communities.

Pesticide application (methoxychlor) to a small headwater stream (treatment stream) resulted in massive invertebrate drift and altered community structure with respect to both biomasses and densities. The community changed from one dominated by insects to one of primarily noninsects. Insects represented 71-78% of total abundance and about 95% of total biomass in an adjacent reference stream during 2 years of study. During the initial treatment year insects, mainly Chironomidae, composed less than 20% of total invertebrate biomass (< 10% of abundance) in treatment stream litterbags. Within 2 years of the initial disturbance, invertebrate biomass in the treatment stream was again dominated by insects. Lanthus vernalis Carle (Odonata: Gomphidae) was among the insect taxa least affected. Diets of larval Lanthus (gut analy-

ses) reflected changes in community structure within the treatment stream (insects represented 13% of prey during the initial treatment year and > 82% during the 2nd year of recovery. In contrast, Lanthus in the reference stream consumed primarily insects in both years). These data indicate that generalist predators such as Lanthus can readily shift to alternative, less profitable prey when confronted by massive changes in community structure. Following the disturbance, Lanthus consumption reflected the recovery of more profitable prey. Secondary production of Lanthus approached 27% of average standing stock biomass of invertebrates in litterbags in each stream. Based on literature values for bioenergetic efficiencies, Lanthus consumed about 65% of the average standing stock biomass of invertebrates. Total consumption necessary to support production of all invertebrate predators may exceed the average standing stock prey biomass by 2.5-2.7 times. However, when prey turnover is considered, the potential impact of this predation on invertebrate community structure may be quite modest. (Author's abstract)
W87-08534

EFFECTS OF ACIDIFICATION ON LIFE-HISTORY TRAITS OF THE FRESHWATER CLAM MUSCULIUM PARTUMEIUM (SAY, 1822) (BIVALVIA: PISIDIIDAE),
Virginia Univ., Charlottesville. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-08536

PHOSPHORUS MODELS APPLIED TO NEW MEXICO RESERVOIRS,
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
S. B. Bolin, T. J. Ward, and R. A. Cole.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 323-335, May 1987. 3 fig, 6 tab, 26 ref.

Descriptors: *Model studies, *Comparison studies, *Phosphorus, *Reservoirs, *Limnology, Simulation, Performance evaluation, New Mexico, Rio Grande basin, Prediction, Settling velocity, Nutrients, Lakes.

Many empirical, mass balance phosphorus models have been developed and tested on northern temperate lakes. Sixteen published models were tested on New Mexico reservoirs to determine their usefulness in simulating reservoir behavior in the Rio Grande basin. The models overpredicted measured seasonal phosphorus concentrations in the reservoirs. Models with settling velocities that varied with selected hydrologic variables performed better than models with constant settling velocities. Model predictions were improved by establishing a relationship between removal rates of phosphorus and certain hydrologic variables. The relationship between settling velocity of phosphorus and reservoir flushing rate was the most significant. Flushing rate also was significantly correlated with the loading rate of total suspended solids. This helps to explain the removal rates observed in the reservoirs. High flushing rates bring in high loads of suspended solids, which may combine with phosphorus and remove it from the water column as the solids settle. (Author's abstract)
W87-08591

RELATIONSHIPS AMONG WATER STORAGE VARIABLES,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
V. Yevjevich, and J. T. B. Obeysekera.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 353-367, May 1987. 12 fig, 1 tab, 4 ref. NSF Grant CEE-8405289/8541631.

Descriptors: *Water storage, *Simulation, *Mathematical studies, *Autocorrelation analysis, Reservoirs.

Among a large number of random variables related to water storage for a give sample size n, the most studied are the range R sub n, deficit D sub n, and negative run-sum V sub n. A simulation of 5,000 samples for various n was performed for three assumed population processes: normal independent, normal dependent, and gamma independent. It was found by simulation, and verified by an analytical derivation, that the range and deficit are equal in 50% of generated samples, while in the other 50% the range is greater than the deficit. Probabilities range from zero to more than 0.60; they decrease as n and skewness increase, but increase as the lag-1 autocorrelation coefficient increases. The ratios of sample means for three storage-related variables, either for 5,000 samples or only for the samples in which the values of these variables are not equal, exhibit these general patterns: (1) Ratios D sub n/R sub n increase with n, converging to an asymptotic value of 0.7854 in the case of 5,000 samples; (2 for R sub n > D sub n samples, the ratios D sub n/R sub n are much smaller than for the entire set of 5,000 samples with R sub n > or D = sub n; (3) ratios V sub n/D sub n and V sub n/R are much smaller than D sun n/R sub n. The pairwise lag-O correlation coefficients for 5,000 sample estimates show that corr (R sub n, D sub n) changes around 0.45 as sn increases in the case C sub s = O; this correlation is small (0 - 0.25), but increases with n for C sub s = 3. for R sub n > D sub n samples, corr (R sub n, D sub n) becomes negative, oscillating aroung -0.07. Corr (D sub n, V sub n) shows a decrease with an increase of n for C sub s = 3, but increases with an increase of autocorrelation. Corr (R sub n, V sub n) decreases with an increase of n, changes slightly with autocorrelation and with skewness. (Author's abstract)
W87-08593

2I. Water In Plants

CANOPY TEMPERATURE OF SUGARCANE AS INFLUENCED BY IRRIGATION REGIME,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
K. L. Khera, and B. S. Sandhu.
Agricultural and Forest Meteorology, Vol. 37, No. 3, p 245-258, August 1986. 6 fig, 3 tab, 23 ref.

Descriptors: *Canopy temperature, *Sugarcane, *Irrigation effects, *Water stress, *Crop production, Prediction, Sugar crops, India, Irrigation, Water deficit, Advection, Regression analysis, Soil water, Distribution, Temporal distribution, Radiation, Solar radiation, Atmospheric water.

A field study was conducted with differentially irrigated sugarcane in the pre-monsoon dry and hot climatic environment of northern India to evaluate canopy temperature as an index of water stress. The stressed crop experienced low to moderately high water deficits. During the hotter part of cloudless days, canopy temperature of the unstressed sugarcane was 2-7 C less than that of the stressed crop. The canopy temperature of both the unstressed and stressed crops remained 1-12 C cooler than the ambient air temperature. The canopy of the early afternoon hours appeared a more promising index of water stress than canopy temperature-air temperature and canopy temperature-air temperature-based crop water stress index, possibly due to the effect of turbulent advection from the surrounding hot environment. Regression analysis showed that the variation in average soil water content in the 180-cm profile alone accounted for 73% variation in canopy temperature during the afternoon hours. The contribution of net radiation and air vapor pressure deficit to the predictability of canopy temperature was small and nonsignificant. (Author's abstract)
W87-07610

BOTANICAL RECONNAISSANCE OF SILVER LAKE RESEARCH NATURAL AREA, NORTH CASCADES NATIONAL PARK, WASHINGTON,
Pacific Northwest Forest and Range Experiment Station, Portland, OR.
For primary bibliographic entry see Field 2H.
W87-07654

EFFECTS OF ENVIRONMENTAL STRESS ON COMPONENTS OF REPRODUCTION IN CLARKIA UNGUICULATA,
California Univ., Riverside. Dept. of Botany and Plant Sciences.
N. L. Smith-Huerta, and F. C. Vasek.
American Journal of Botany AJBOAA, Vol. 74, No. 1, p 1-8, January 1987. 5 tab, 38 ref.

Descriptors: *Reproduction, *Drought, *Drought resistance, *Water stress, Plant growth, Seeds, Flowering.

The effects of stress on reproduction in Clarkia unguiculata were investigated by monitoring flower number, seed number and seed weight after subjecting plants to drought and heavy fruit loads, and by monitoring seed number after pollinating overage flowers. Fewer main-stem flowers were produced in drought stressed plants than in non-stressed plants. Drought stress did not affect overall seed numbers and seed weight in 1981, but did significantly affect seed number and weight in different flower age classes. Overall seed numbers were not affected by drought stress in 1982, but seed weight was significantly lower in plants with stressed ovules. Fewer flowers but more seeds per pollination were produced by plants in which all or one-half the flowers were pollinated than by plants in which one-fourth or one-sixth of the flowers were pollinated. Seed weights were lowest in plants with a full fruit load and in fruits produced late in the growth cycle. Seed number was variable but high following pollination of flowers with 1-7 day old stigmas, and much lower in flowers with older stigmas. (Authors' abstract)
W87-07811

INFLUENCE OF IAA ON THE UPTAKE OF POTASSIUM, CALCIUM, MAGNESIUM, WATER ABSORPTION AND GROWTH IN YOUNG MAIZE SEEDLINGS,
Karlova Univ., Prague (Czechoslovakia).
O. Votrubova, and M. Votrubova.
Biologia Plantarum PBABAJ, Vol. 28, No. 6, p 460-464, 1986. 2 fig, 2 tab, 12 ref.

Descriptors: *Accumulation, *Water use, *Plant growth substances, *Plant growth, *Indoleacetic acid, *Corn, Plant physiology, Potassium, Calcium, Magnesium.

The uptake, translocation and distribution of mineral ions are affected by various growth regulators, including IAA (indoleacetic acid). The influence of IAA in two concentrations (0.0001 and 0.0000001 M) on relations between growth, water absorption and cation uptake and accumulation was tested. IAA in a higher concentration retarded growth remarkably. First of all, potassium uptake and water absorption were significantly decreased while the uptake of divalent cations was affected later and less remarkably. The lower concentration accelerated the growth rate slightly together with acceleration of water absorption and cation uptake. (Authors' abstract)
W87-07813

TRIALKYLLEAD OCCURRENCE, BIOLOGICAL INTERACTIONS, AND POSSIBLE IMPACT ON FOREST DECLINE,
Max-Planck-Inst. fuer Medizinische Forschung, Heidelberg (Germany, F.R.). Abt. Physiologie.
For primary bibliographic entry see Field 5C.
W87-07820

EFFECT OF SOIL WATER AND TEMPERATURE ON CORN (ZEA MAYS L.) ROOT GROWTH DURING EMERGENCE,
Manitoba Univ., Winnipeg. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W87-07908

EFFECT OF SOIL MOISTURE AND PH ON THE RESPONSE OF ALFALFA TO MOLYBDENUM (EFFETS DES REGIMES HYDRIQUES ET DES PH DU SOL SUR LA REPONSE AU MOLYBDENE DE LA LUZERNE),
Department of Agriculture, Lennoxville (Quebec).

Station de Recherches.
For primary bibliographic entry see Field 2G.
W87-07914

FACTORS CONTROLLING THE GROWTH FORM OF SPARTINA ALTERNIFLORA: FEEDBACKS BETWEEN ABOVE-GROUND PRODUCTION, SEDIMENT OXIDATION, NITROGEN AND SALINITY,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 2L.
W87-07964

SPECIES COMPETITIVE ABILITY AND POSITION ALONG A NATURAL STRESS DISTURBANCE GRADIENT,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-07970

ROLE OF LIFE HISTORY PROCESSES IN PRIMARY SUCCESSION ON AN ALASKAN FLOODPLAIN,
Alaska Univ., Fairbanks. Inst. of Arctic Biology and Museum.
L. R. Walker, J. C. Zasada, and F. S. Chapin.
Ecology ECOLAR, Vol. 67, No. 5, p 1243-1253, October 1986. 4 fig, 5 tab, 63 ref.

Descriptors: *Life history studies, *Succession, *Alaska, *Flood plains, *Ecological distribution, *Species composition, *Stochastic process, *Trees, Spruce trees, Willow trees, Phreatophytes, Seeds, Distribution, Temporal distribution, Seedlings, Growth, Growth rates, Dispersal, Ecology, Distribution patterns, Germination, Litter, Flooding, Mortality, Alder trees, Poplar trees, Forests, Rivers.

A study was undertaken to determine the degree to which life history traits (seed rain, seedling establishment, and longevity) direct a primary successional sequence on the Tanana River flood plain of Alaska. It was concluded that these life history traits of the dominant species, interacting with stochastic events, are sufficient to explain patterns of species arrival and change through the primary successional sequence. Seed rain by willow, alder, poplar, and spruce varied substantially among years, but was highest in the successional stage dominated by that species. The copious, wind-dispersed seeds and rapid seedling growth rates of willow and poplar resulted in their abundant establishment on early successional vegetated-silt bars. Heavier alder and spruce seeds were less widely distributed, but rapid growth rates of alder resulted in dense alder thickets within 20 years of silt-bar formation. Spruce was the only species colonizing mid- and late-successional sites. Flooding resulted in substantial mortality of seedlings in early-successional sites. A combination of short life span, herbivory by hares, and shade intolerance eliminated willow from mid-successional alder-dominated sites. Thereafter, differences in longevity explained successional change from alder to poplar to spruce. Facilitative interactions among species did not appear essential to explain changes in species composition in the successional sequence. (Author's abstract)
W87-07971

MOUNT ST. HELENS ASH: RECREATING ITS EFFECTS ON THE STEPPE ENVIRONMENT AND ECOPHYSIOLOGY,
Washington State Univ., Pullman. Dept. of Forestry and Range Management.
For primary bibliographic entry see Field 2D.
W87-07974

SEDIMENT-RELATED MECHANISMS OF GROWTH LIMITATION IN SUBMERSED MACROPHYTES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
J. W. Barko, and R. M. Smart.
Ecology ECOLAR, Vol. 67, No. 5, p 1328-1340, October 1986. 7 fig, 6 tab, 91 ref.

Descriptors: *Lake sediments, *Growth, *Submerged plants, *Macrophytes, *Organic matter, *Sedimentology, *Density, Aquatic plants, Sediments, Nutrients, Accumulation, Bioaccumulation, Shoots, Statistical analysis, Interstitial water, Nutrition, Phosphorus, Iron, Nitrogen, Heavy metals.

The relationships between growth of submersed macrophytes and sediment composition is examined. Myriophyllum spicatum and Hydrilla verticillata grown on 40 different sediments from 17 geographically widespread North American lakes indicated 10- and 20-fold declines in growth with increasing sediment organic matter up to a concentration of 20% dry sediment mass. Poor growth was obtained also on inorganic sediments with a sand fraction exceeding 75% dry sediment mass. Sediment density rather than organic matter content was most influential in regulating growth. Macrophyte growth and nutrient mass accumulation in shoots were highly correlated with sediment nutrient concentrations based on volume, indicating interrelationships among growth, nutrition, and sediment density. Additions of P and Fe in combination to organic sediments with N supplied in the overlying solution resulted in significant growth increases in Hydrilla, suggesting that diminished growth on unfavorable sediments was caused by multiple nutrient limitation. Nutrient uptake on low-density organic sediments was apparently limited by long diffusion distances. Limited rates of nutrient diffusion and exchange in coarse-textured sediments, in addition to low nutrient status, may have contributed to their poor ability to support macrophyte growth. Thus, mechanisms of growth limitation on both sands and organic sediments appear to involve nutrition. (Author's abstract)
W87-07975

PRODUCTION, PREDATION, AND DECOMPOSITION IN A LOW-SALINITY HIBISCUS MARSH,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
For primary bibliographic entry see Field 2L.
W87-07976

LIMNETIC HERBIVORY: EFFECTS ON PHYTOPLANKTON POPULATIONS AND PRIMARY PRODUCTION,
Notre Dame Univ., IN. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W87-07977

XYLEM CAVITATION IN NODES AND INTERNODES OF WHOLE CHORISIA INSIGNIS H.B. ET K. PLANTS SUBJECTED TO WATER STRESS: RELATIONS BETWEEN XYLEM CONDUIT SIZE AND CAVITATION,
Messina Univ. (Italy). Ist. di Botanica.
S. Salleo, and M. A. Lo Gullo.
Annals of Botany ANBOA4, Vol. 58, No. 4, p 431-441, October 1986. 6 fig, 1 tab, 25 ref.

Descriptors: *Cavitation, *Water stress, *Stems, *Plant physiology, *Chorisia, Flow, Stress, Water potentials, Leaves, Isotherms, Stomata, Transpiration, Stomatal transpiration.

Cavitation was measured in xylem conduits of different stem parts in whole Chorisia insignis plants subjected to water stress. The most vulnerable parts were one-year-old twigs, where cavitation reached a peak of more than 50 acoustic emissions (AE)/min, while in two-year-old twigs AE/min were about one half this value. Cavitation was typically very low even during water stress in one-year-old nodes and junctions where branches meet. Measurements showed that nodes have a significantly larger percentage of narrow xylem conduits than internodes. Similar 'constricted zones' were found in junctions with respect to two-year-old twigs, where about 50% of the xylem conduits were as narrow as 20 to 50 microns in diameter. About 3% of xylem conduits end in the nodes and 1% in the internodes of one-year-old twigs. About 11.6% of xylem conduits end in the junctions and about a half in two-year-old internodes. These data support the functional concept of 'plant segmentation' into zones (internodes) more efficient in water conduction (i.e., with wider xylem conduits but more vulnerable to cavitation) and others (nodes and junctions) with opposite characteristics. (Author's abstract)
W87-07999

LEAF PROPERTIES RELATED TO THE PHOTOSYNTHETIC RESPONSE TO DROUGHT IN UPLAND AND LOWLAND RICE VARIETIES,
Tohoku Univ., Sendai (Japan). Lab. of Plant Breeding.
For primary bibliographic entry see Field 2D.
W87-08000

CHARACTERIZATION OF PEACH ROOTS IN FOX SAND AS INFLUENCED BY SPRINKLER IRRIGATION AND TREE DENSITY,
Department of Agriculture, Harrow (Ontario). Research Station.
For primary bibliographic entry see Field 3F.
W87-08012

WATER RELATIONS AND WATER POTENTIAL MEASUREMENTS FOR VEGETATIVE POINSETTIA,
Florida Univ., Gainesville. Dept. of Ornamental Horticulture.
J. E. Barrett, and T. A. Nell.
Journal of the American Society for Horticultural Science JOSHB5, Vol. 111, No. 5, p 773-776, September 1986. 4 fig, 1 tab, 20 ref.

Descriptors: *Hydrologic budget, *Leaves, *Water potential, *Poinsettia, *Measuring instruments, *Soil-water-plant relationships, *Plant physiology, Horticulture, Ornamentals, Stress, Water vapor, Drought, Water stress, Stomata, Turgidity, Temperature, Correlation coefficient, Leaves.

Pressure chamber and thermocouple psychrometer measurements of leaf water potentials were evaluated in vegetative Euphorbia pulcherrima. The two methods agreed within 0.2 MPa between -0.3 and -1.8 MPa and were equal at - 1.1 MPa. Minimum daily water potential for nonstressed plants reached - 0.67 MPa by 1230 hr. Abaxial water vapor conductance and water potential varied little between 1230 and 1630 hr. When drought was imposed, incipient stomatal closure occurred at -0.8 MPa with full closure observed at -1.2 MPa. Complete loss of turgor pressure occurred at water potentials between -1.2 and -1.4 MPa. The linear correlation coefficient for conductance and leaf-air temperature differential was 0.96, with leaf and air temperature equal when conductance was 0.6 cm/s. Xylem pressure potentials of upper leaves on drought-stressed plants declined to -1.7 MPa in 8 days and abscission of proximal leaves began. There was little change in xylem pressure potentials of upper leaves after leaf abscission began. (Author's abstract)
W87-08013

EFFECTS OF WATER STRESS ON POLLEN OF PHASEOLUS VULGARIS L.,
California Univ., Davis. Dept. of Agronomy and Range Science.
X. Y. Shen, and B. D. Webster.
Journal of the American Society for Horticultural Science JOSHB5, Vol. 111, No. 5, p 807-810, September 1986. 4 fig, 1 tab, 20 ref.

Descriptors: *Water stress, *Pollen, *Beans, *Soil-water-plant relationships, *Germination, *Palynology, Stress, Drought resistance, Taxonomy, Plant physiology.

Pollen of plants of Phaseolus vulgaris 'Red Mexican' is affected adversely by water stress. The critical stress period occurs 10-13 days after emergence, during the transition from the vegetative to the reproductive phase of development. The transition phase is characterized by the presence of tiny green buds (> 0.5-2.0 mm in length) bearing anthers that contain tetrads or free microspores. Pollen abortion of plants stressed during the transition phase is significantly higher than that of pollen

from nonstressed plants or from those stressed during later phases of reproductive development. The percentage of pollen germination and total pollen production also are reduced in transition phase-stressed plants. Exine development is abnormal; this abnormal development is particularly interesting because the exine is regarded as so genetically stable that it is regularly used for species identification. Results of these experiments raise questions about the infallibility of identifications, since an environmental stress imposed at a critical time of gametophytic development can markedly alter exine patterning. (Author's abstract)
W87-08014

RESPONSES TO SATURATION DEFICIT IN A STAND OF GROUNDNUT (ARACHIS HYPOGAEA L.): 1. WATER USE,
Nottingham Univ. (England). School of Agriculture.
L. P. Simmonds, and C. K. Ong.
Annals of Botany ANBOA4, Vol. 59, No. 2, p 113-119, February 1987. 6 fig, 1 tab, 17 ref.

Descriptors: *Peanuts, *Groundnut, *Saturation deficit, *Plant water use, *Transpiration, *Soil water, Canopy, Solar radiation, Stomatal closure, Humidity, Soil profiles, Plants.

Stands of groundnut were grown in computer-controlled glasshouses on water stored in an undisturbed soil profile. The maximum saturation vapor pressure deficit (D) of the air was either 1.0, 2.0, 2.5, or 3.0 kPa, and the mean air temperature was 27 C. Transpiration (E), determined from the soil water balance, was strongly dependent on D, because D influenced both the fraction of incident solar radiation intercepted by foliage (f) and the transpiration rate per unit f (E/f). When D exceeded 2 kPa, canopy expansion was restricted and f reduced during early growth, but differences in f diminished as the canopies closed. E/f increased with D, implying that any restriction of transpiration through stomatal closure at large D was outweighted by a steeper humidity gradient from leaf to air. In all treatments E/f decreased as the soil profile dried. Saturation deficit per se had little influence on the proportional reduction in E/f with time, even though soil water deficit was considerably greater at large D. This lack of response occurred because plants compensated for the greater evaporative demand by extracting larger amounts of water from deep in the profile. (See also W87-08048) (Author's abstract)
W87-08047

RESPONSES TO SATURATION DEFICIT IN A STAND OF GROUNDNUT (ARACHIS HYPOGAEA L.). 2. GROWTH AND DEVELOPMENT,
Nottingham Univ. (England). Dept. of Mathematics.
C. K. Ong, L. P. Simmonds, and R. B. Matthews.
Annals of Botany ANBOA4, Vol. 59, No. 2, p 121-128, February 1987. 3 fig, 5 tab, 17 ref.

Descriptors: *Groundnut, *Saturation deficit, *Plant water use, *Peanuts, *Transpiration, *Soil water, Irrigation, Roots, Leaves, Productivity, Soil profiles, Plants.

Stands of groundnut were grown in four glasshouses with the maximum saturation deficit (D) of the air limited to 1.0, 2.0, 2.5 or 3.0 kPa. The soil was near field capacity when plants emerged and no water was applied thereafter. In a fifth glasshouse, a stand was grown at low D on soil irrigated to field capacity every few days. Developmental processes such as timing of flowering, pegging and pod formation were unaffected by D, but the numbers of branches, flowers and pegs were reduced in the drier treatments. Measurements during the first 30 d showed that in the drier treatments leaf growth was reduced, and the partitioning of dry matter into roots was enhanced. In the unirrigated stands, dry matter production in shoots was reduced by 40 per cent as the maximum D increased from 1.0 to 3.0 kPa. Growth was affected through reductions both in leaf area (and therefore light interception) and in the productivity per unit of light intercepted. These responses to D and soil water were linked to changes in bulk water potential of leaves. Productivity per unit of water transpired (q) decreased with increasing D. The product of q and the mean daytime value of the difference in vapor pressure between leaf and air was more conservative than q, and ranged from 3.1 to 5.6 g kPa/kg. (See also W87-08047) (Author's abstract)
W87-08048

ELEMENTAL COMPOSITION OF JUNCUS BULBOSUS IN AN ACIDIFIED FRESHWATER RESERVOIR,
Turku Univ. (Finland). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-08106

EFFECT OF AMBIENT OZONE POLLUTION AND ACIDIC RAIN ON THE GROWTH AND CHLOROPHYLL CONTENT OF GREEN AND WHITE ASH,
New Jersey Agricultural Experiment Station, New Brunswick.
For primary bibliographic entry see Field 5C.
W87-08111

EFFECT OF FERTILIZER ON THE GROWTH OF RADISH PLANTS EXPOSED TO SIMULATED ACIDIC RAIN CONTAINING DIFFERENT SULFATE TO NITRATE RATIOS,
Boyce Thompson Inst. for Plant Research, Ithaca, NY.
For primary bibliographic entry see Field 5C.
W87-08112

SUMMER AND WINTER RAINFALL INTERCEPTION IN AN OAK FOREST. PREDICTIONS WITH AN ANALYTICAL AND A NUMERICAL SIMULATION MODEL,
Groningen Rijksuniversiteit (Netherlands). Dept. of Physical Geography.
For primary bibliographic entry see Field 2B.
W87-08117

OSMOTIC ADJUSTMENT, INDUCED BY DROUGHT, IN SEEDLINGS OF THREE EUCALYPTUS SPECIES,
Melbourne Univ., Parkville (Australia). Dept. of Botany.
B. A. Myers, and T. F. Neales.
Australian Journal of Plant Physiology AJPPCH, Vol. 13, No. 5, p 597-603, September 1986. 1 fig, 2 tab, 24 ref.

Descriptors: *Plant water potential, *Osmotic adjustment, *Drought effects, *Seedlings, *Eucalyptus, Wilting, Turgor, Plant physiology, Seasonal variation.

Osmotic adjustment was observed in pot-grown seedling of Eucalyptus behriana, E. microcarpa and E. polyanthemos that had been subjected to one and two periods of drought. The osmotic potential of sap expressed from rehydrated leaves was significantly lower in seedlings which had wilted twice (-2.02 + or - 0.05 MPa) compared with those which had wilted once (-1.86 + or - 0.05 MPa) and those which had been watered daily (-1.66 + or - 0.05 MPa). After two drought cycles, seedlings began to wilt at lower mean values of plant water potential (-3.51 + or - 0.22 MPa) than those whic had not wilted previously (- 3.14 + or - 0.22 MPa). Thus drought-induced osmotic adjustment apparently enhanced turgor maintenance. The ratio of turgid weight to dry weight was slightly, but significantly, smaller in the seedlings subjected to two drought cycles (3.83 + or - 0.04 MPa) compared with those subjected to one drought cycle (4.05 + or - 0.04). The osmotic adjustment that was induced by two drought cycles in these seedlings was about one third of the observed seasonal osmotic adjustment in mature trees of E. behriana and E. microcarpa in the field. (Author's abstract)
W87-08135

EFFECTS OF ACID RAIN ON PLANT MICROBIAL ASSOCIATIONS IN CALIFORNIA,
California Univ., Berkeley. Dept. of Plant and Soil Biology.
For primary bibliographic entry see Field 5C.
W87-08217

THOUSAND YEARS OF DEATH,
King's Coll., London (England). Dept. of Biology.
P. Moore.
New Scientist NWSCAL, Vol. 113, No. 1542, p 46-48, January 1987. 1 fig.

Descriptors: *Bogs, *Peat bogs, Wetlands, Aquatic plants, Mosses, Peat.

Peatlands differ from stable habitats in that they are unbalanced. Energy rich organic matter builds up for thousands of years, accumulating not in living plant tissues but in the form of dead plant litter. Waterlogged, anaerobic conditions and cold temperatures prevent microoranisms from decomposing plant litter as fast as it is produced. Over several centuries the accumulation of vegetation raises the ground surface above the water level. Raised bogs may be several meters in height and 2 or more kilometers in diameter. Compression and sideways movement lead to a constant loss of material. As the bog rises, it becomes dependent on rainfall as its water source. Blanket bogs differ in that they form a uniform shroud over the landscape, covering both hills and valleys. The entire mass of a bog expands and contracts according to the degree it is charged with water. Complex patterns of vegetative growth form interconnecting systems of hummocks and ridges, interspersed with pools. Water moves on the surface in a slow and sinous fashion. Bogs have a distinctive, although not rich, flora. Sphagnum mosses, sedges, heather, and nutrient-seeking insectivorous plants such as sundews and pitcher plants are characteristic. Some bogs may be anthropogenic in that early inhabitants stripped away forests for agriculture but subsequent runoff and erosion producing silting and flooding, and eventually bog formation. (McFarlane-PTT)
W87-08257

CANOPY STRUCTURE AND CLOUD WATER DEPOSITION IN SUBALPINE CONIFEROUS FORESTS,
New York Botanical Garden, Bronx, NY. Inst. of Ecosystem Studies.
For primary bibliographic entry see Field 2B.
W87-08301

PHENOTYPIC FLEXIBILITY OF CAREX FLACCA SCHREB.: TOLERANCE OF SOIL FLOODING BY POPULATIONS FROM CONTRASTING HABITATS,
University Coll., Cork (Ireland). Dept. of Plant Science.
C. A. Heathcote, M. S. Davies, and J. R. Etherington.
New Phytologist NEPHAV, Vol. 105, No. 3, p 381-391, March 1987. 3 fig, 3 tab, 43 ref.

Descriptors: *Carex, *Soil flooding, *Drainage, *Plant growth, *Waterlogging, *Flooding, *Wet soils, Plants, Roots, Nutrients, Iron, Manganese, Shoots, Phenotypes.

Nine populations of Carex flacca Schreb., collected from sites which vary widely in their liability to soil flooding, were grown on an experimental soil with free drainage, transient flooding or continuous flooding for 26 weeks. Although the flooding treatments resulted in low redox potentials and high concentrations of reduced iron and manganese in the soil, the growth of C. flacca plants was little affected by flooding. All populations grew equally well on the flooded soils. All populations produced adventitious roots at the soil surface in the flooded treatments; these were absent from plants grown on the freely drained soil. Flooding produced an increase in the manganese concentration of roots and shoots but, although the iron content of roots was markedly increased by flooding, there was no increased transport to the shoots. In view of the absence of detectable phenotypic differentiation between these populations from widely contrasting sites and their unimpaired

growth on severely waterlogged soils, it is argued that C. flacca plants have a broad tolerance (phenotypic flexibility) of soil flooding. This may be important in the wide ecological amplitude of this species. (Author's abstract)
W87-08326

WATER RELATIONS OF MYCORRHIZAL AND PHOSPHORUS-FERTILIZED NON-MYCORRHIZAL CITRUS UNDER DROUGHT STRESS,
Agricultural Research and Education Center, Lake Alfred, FL.
J. H. Graham, J. P. Syvertsen, and M. L. Smith.
New Phytologist NEPHAV, Vol. 105, No. 3, p 411-419, March 1987. 2 fig, 2 tab, 28 ref.

Descriptors: *Mycorrhiza, *Drought stress, *Plant water relations, *Phosphorus, *Fertilizers, *Citrus, Drought effects, Seedlings, Transpiration, Leaves, Water potentials, Roots.

Rootstock seedlings of Carrizo citrange (Poncirus trifoliata (L.) Raf. x C. Sinensis (L.) Osbeck) and sour orange (Citrus aurontium L.) were grown in a sandy soil low in phosphorus (P) and either inoculated with Glomus intraradices Schenck and Smith (vesicular-arbuscular mycorrhizal; VAM) or fertilized with soluble P (non-mycorrhizal; NM). Five-month-old VAM and NM seedlings of each rootstock were comparable in size, P sufficiency, and relative growth rate whether they were kept well-watered or subjected to two drought-stress cycles of short duration. Under well-watered conditions, whole plant transpiration, leaf water status, and root hydraulic conductivity were similar for VAM and NM plants of each rootstock. During drought-stress and recovery periods, VAM plants also had very comparable whole-plant transpiration rates and leaf water potentials to NM plants, but mycorrhiza reduced root hydraulic conductivity of Carrizo citrange and sour orange 66 and 49%, respectively. These data do not support the hypothesis that mycorrhiza significantly enhance water relations of citrus under the drought-stress conditions studied. (Author's abstract)
W87-08327

2J. Erosion and Sedimentation

MATHEMATICAL SIMULATION MODEL FOR ENVIRONMENTAL TRANSPORT PROCESSES IN TIDAL RIVERS AND ESTUARIES,
GKSS - Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik.
J. Hauser, D. Eppel, M. Lobmeyr, and A. Muller.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84-751505. Price codes A01 in Microfiche and A02 in paper copy. 1983. 9 p. 5 fig, 22 ref.

Descriptors: *Simulation analysis, *Model studies, *Mathematical models, *Tidal rivers, *Estuaries, *Sediment transport, *Path of pollutants, *West Germany, *Weser River, Heavy metals, Mathematical equations, Data interpretation, Physical properties.

A mathematical model is presented for numerical simulation of transient, two-dimensional transport processes in tidal rivers, bays and estuaries with particular emphasis to suspended sediment and heavy-metal transport. The numerical formulation employs the integral forms of the conservation principles for mass, suspended sediment, dissolved and particulate heavy-metal concentrations. The solution area may be multiple-connected and is spanned by variable-sized discrete elements which may have curved boundaries to exactly match the boundary of the specified flow region. This paper begins with a detailed discussion of the difficulties encountered in the description of suspended and heavy-metal transport processes and their subsequent verification by field-measured data. It is shown that at the present state of knowledge a completely verified sediment transport model cannot be obtained. On one hand, there is a lack of data causing severe uncertainties in the parameters of the simulation equations, e.g. the distribution coefficients describing the sediment heavy-metal interactions. On the other hand it is not clear whether all significant physical processes have been incorporated into the model, i.e. at the moment neither hindered settling nor wave action is considered. As a result of an application of the simulation model thermal plume calculations in the Lower Weser River and their comparisons with field-measured data are presented. (Lantz-PTT)
W87-07660

LAND: RESOURCE BASE AND INVENTORY,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 7A.
W87-07682

FOREST LAND: CONSERVATION NEEDS, TECHNOLOGY, AND POLICY ALTERNATIVES,
Intermountain Forest and Range Experiment Station, Boise, ID. Forestry Sciences Lab.
W. F. Megahan, D. H. Boelter, S. P. Gessel, J. W. Hornbeck, and J. R. Meiman.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc, Madison, Wisconsin, 1981. p 103-125, 23 ref.

Descriptors: *Soil conservation, *Forest management, *Forest watersheds, *Research priorities, *Soil erosion, Sedimentation, Streamflow, Chemical properties, Fate of pollutants, Logging, Cutting management, Water quality, Pesticides, Forest soil, Riparian land, Ecological effects, Productivity.

Forest land makes up about 30% of the total land area in the United States and is the major source of the nation's water supplies. As the area of forest land is decreasing, demands on the remaining forest land for timber, fuel, waste disposal, wildlife, recreation, range, and water and mineral resources are increasing. Most of the soil losses on forested lands are from a relatively small percentage of the area and are caused by gullying, landslides, and stream channel erosion. The volume and timing of streamflow as well as its quality are especially important in forest land management because of their effects on fish and wildlife and on downstream users. Forest productivity is closely linked to erosion and sedimentation processes and nutrient cycling. Riparian zones are particularly important because of their high productivity, habitat value, and effects on stream properties. Soil and water research needs on forest land fall into five main areas: erosion and sedimentation, quantity and timing of streamflow, water chemistry, effects of forestry practices on the riparian zone, and forest land productivity. Better techniques are needed to predict the effects of forest management activities on erosion and sedimentation. More fundamental research on the effects of forest management on water use by plants, water pathways to streams, and snow accumulation and melt is required. The cycling of natural and introduced chemicals in forest ecosystems and their effects on the quality of lakes and streams should be examined to help select practices to improve stream quality. Research is needed to understand the impact of forestry practices on water chemistry, temperature, sedimentation, and forest debris in the riparian zone. Research needed to improve forest land productivity involves site-specific classification of productivity for all forest soils and identifying factors that determine, enhance, or reduce productivity. (See also W87-07680) (Geiger-PTT)
W87-07686

GREENLAND CASE STUDY: WATER SUPPLY,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2C.
W87-07713

FATE OF METALS IN THE SEDIMENTS OF THE NEW YORK BIGHT,
National Mariculture Centre, Eilat (Israel).
For primary bibliographic entry see Field 5B.
W87-07738

ENERGETICS OF DREDGED-MATERIAL DISPERSAL,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W87-07742

SEDIMENT BUDGET NEAR THE NEW YORK BIGHT DUMPSITES: IMPLICATIONS FOR POLLUTANT DISPERSAL,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
D. J. P. Swift, W. L. Stubblefield, T. L. Clarke, R. A. Young, and G. L. Freeland.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 319-355, 20 fig, 9 tab, 63 ref.

Descriptors: *Coastal waters, *Sediment transport, *New York Bight, *Waste disposal, *Path of pollutants, *New Jersey, Ocean dumping, Tidal currents, Estuaries, Hudson River, Wastewater disposal, Sludge.

The fine-sediment transport system of the New York Bight apex is highly dispersive; the residence time of particles subject to storm current and tidal current transport, excluding those involved in the high-speed productivity cycle, is 10.6 d. Transport in the New York Bight is tidally induced in estuaries, lagoons, and tidal inletes but storm-induced on the open shelf. Intense winter storms can resuspend 10,000 t/sq km of fine sediment over several hours, and the particles follow mean trajectories of tens of kilometers for several days before settling out. Fine-sediment transport may be modelled as a diffusion-advection system, in which time and space scales are in the order of tens of kilometers and hundreds of years. Three important pathways of the sediment transport system are the southwesterly directed along-shelf flux, conservatively estimated at 1,000,000 t/yr; the Hudson River input of 1,000,000 t/yr; and the portion of dumped material that escapes burial and joins the transport system (300,000 t/yr). The productivity cycle (14,000,000 t/yr) from living organisms to organic matter and back overwhelms most other pathways. Marshes, estuaries, and lagoons in the bight apex are important sinks (estimated to receive 2,400,000 t/yr of fine sediment). Coprostanol ratios reveal significant sewage sludge contamination of lagoons and estuaries, although the point of entry of the sewage cannot be established. At least 1,000,000 t of fine sediment escapes south along the New Jersey coast each year. Other sinks for suspended fine sediment include the Christiaensen Basin, where ocean dumping occurs (2,300,000 t/yr), and the floor of the adjacent shelf valley. Depositional rates away from the dumpsites are lower (< 100,000 t/yr), but the sediments reveal elevated coprostanol and trace metal values. (See also W87-07729) (Author's abstract)
W87-07743

HIGH-ENERGY NEARSHORE PROCESSES,
Oregon State Univ., Corvallis.
R. A. Holman, and A. H. Sallenger.
Eos EOSTA, Vol. 67, No. 49, p 1369-1371, December 1986. 4 fig, 20 ref. ONR Contract N00014-84-0218.

Descriptors: *Hydrodynamics, *Seashores, *Beach erosion, *Nearshore processes, Waves.

Major storm events dominate the episodic erosion history of an area. Actual erosion is not directly related to large storm waves, but to infragravity waves that pass the information of the storm to the inner surf zone and shoreline. The process of wave breaking severely limits the height of incident (offshore) waves in the inner surf zone so that the main effect of increasing offshore wave height is simply to increase the width of the surf zone. For typical steep beach conditions the maximum runup height at incident frequencies would be approximately 1 m; for beaches of low slope, 10 cm would be more typical. The nearshore region can be though of as a natural waveguide, an approach that points out the analogies between nearshore flows and many other geophysical waves. When the

nearshore acts as a waveguide, it can produce both trapped and leaky wave motions. The trapped waves, called edge waves, are analogous to other waveguide motions, including coastal-trapped waves on the continental shelf and surface seismic waves in the lithosphere. Proving the existence of edgewaves on natural beaches has been difficult. Nearshore processes present difficult sampling problems. A few successful approaches are described. One technique, particularly suitable to analysis of edge waves with their potentially large longshore length scales, is time-lapse photography. Video images can be processed with an automatic real-time digital imaging package. (McFarlane-PTT)
W87-07804

EFFECTS OF RESIDUE HARVESTING ON WATER RUNOFF, SOIL EROSION, AND NUTRIENT LOSS,
Agricultural Research Service, Morris, MN. North Central Soil Conservation Research Center.
For primary bibliographic entry see Field 4C.
W87-07821

RELATION OF LAKE BED LEAKANCE TO GEOLOGICAL PROPERTIES,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W87-07847

CONCENTRATION OF VERY FINE SILTS IN A STEADY VORTEX,
Colorado State Univ., Fort Collins.
P. Y. Julien.
Journal of Hydraulic Research JHYRAF, Vol. 24, No. 4, p 255-264, 1986. 5 fig, 11 ref.

Descriptors: *Hydrodynamics, *Sediment transport, *Silt, *Sediments, *Vortices, Theoretical analysis, Mathematical equations, Mathematical studies, Suspended sediments, Density, Fluctuations, Equilibrium, Rankine vortices, Experimental data, Sediment concentration.

The presence of fine sediment particles in a steady horizontal vortex is examined theoretically and experimentally. Starting from an homogeneous mixture, particles denser than the surrounding fluid are moved outside the vortex core by centrifugal action. As sediment concentration gradient gradually builds up across the vortex, a diffusive flux opposite to the centrifugal flux is induced. Equilibrium is reached when the two fluxes are equal. Theoretical relationships describing the suspended sediment concentration profiles in a steady Rankine vortex are verified with experimental data. (Author's abstract)
W87-07863

VELOCITY DISTRIBUTION IN ALLUVIAL CHANNEL FLOW,
Karnataka Regional Engineering Coll., Suratkal (India).
For primary bibliographic entry see Field 2E.
W87-07864

VORTEX FORMATION IN THE MIXING LAYER BEHIND DUNES,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Wasserwirtschaft.
A. Muller, and A. Gyr.
Journal of Hydraulic Research JHYRAF, Vol. 24, No. 4, p 359-375, 1986. 19 fig, 1 tab, 32 ref.

Descriptors: *Hydrodynamics, *Vortices, *Dunes, *Flow, *Sediment transport, *Sediments, Mathematical equations, Mathematical studies, Flow characteristics, Boundary layers, Mixing layers.

Flow processes in the mixing layer behind dunes provide feedback between flow, sediment transport and the bed forms. This is assumed to be responsible for the development and persistence of dunes. An attempt is made to classify these flow processes in terms of coherent structures the vorticity of the upstream boundary layer is concentrated. Information from observation of flow patterns using dye tracers was used to describe these vortical structures. The literature was reviewed to search for theoretical and experimental results of similar flow situations, which can provide the essential concepts. (Author's abstract)
W87-07865

RESPONSE OF STREAM BENTHOS AND DRIFT TO FINE SEDIMENT DEPOSITION VERSUS TRANSPORT,
Calgary Univ. (Alberta). Aquatic Ecology Section.
For primary bibliographic entry see Field 2H.
W87-07899

EROSION CONTROL IMPROVES COMMUNITY WATER SUPPLY,
Taranto, Stanton and Tagge, Fort Collins, CO.
B. D. Richter.
Public Works PUWOAH, Vol. 118, No. 1, p 80, 114, January 1987.

Descriptors: *Water supply, *Domestic water, *Erosion control, *Water quality management, *Project planning, Planning, Engineering, Construction, Inspection, Legal aspects, Permits, Water policy.

The Castle Pines and Castle Pines North Metropolitan districts of Denver, CO have developed a comprehensive erosion control program for their communities, which is expected to reduce erosion and sedimentation rates during construction activities by as much as 90%. These districts comprise an area of about 4,000 acres south of the city. Enforcement of these criteria is expected to result in net maintenance cost savings of $2,000 to $6,000 per acre per year of construction activity. Enforcement strategy is based on a five-point approach, including plan reviews, construction inspections, assessment of fines for non-compliance, and requirements for obtaining a grading permit and submitting a completion bond. Details of the program are discussed. (Doria-PTT)
W87-07929

DECOMPOSITION OF 14CLABELED ORGANIC SUBSTANCES IN MARINE SEDIMENTS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2K.
W87-07948

SEDIMENT STABILITY AROUND ANIMAL TUBES: THE ROLES OF HYDRODYNAMIC PROCESSES AND BIOTIC ACTIVITY,
South Carolina Univ., Columbia. Dept. of Biology.
M. W. Luckenbach.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 779-787, July 1986. 3 fig, 2 tab, 31 ref.

Descriptors: *Marine sediments, *Polychaetes, *Hydrodynamics, *Biological properties, *Entrainment, *Marine environment, *Sedimentology, Sediments, Aquatic animals, Marine animals, Annelids, Water properties, Density, Population density, Cores, Environment, Erosion, Sedimentation, Sedimentation rates, Flow characteristics, Species composition.

Experiments on the entrainment of surface sediments around polychaete tubes at natural and manipulated densities were conducted in a recirculating seawater flume. Intact cores with either 0 or 8 Diopatra cuprea tubes per 0.01 sq m plus associated assemblages were collected in the field. Sediments which contained D. cuprea tubes had natural macrofaunal densities > five times those of sediments without tubes. To distinguish between organism-induced sediment effects and the hydrodynamic effects of tubes on the critical entrainment velocities of these sediments, experiments were conducted using cores with eight tubes per 0.01 sq m (tubes and high macrofaunal density), similar cores with tubes removed (no tubes and high macrofaunal density), cores with eight tubes added (tubes and low macrofaunal density), and cores without tubes (no tubes and low macrofaunal density). Critical entrainment velocities for natural cohesive sediments in these treatments were 46% lower in the cores with high densities of macrofauna than in those with low densities. The implication is that biotically mediated sedimentological changes around D. cuprea tubes, rather than alterations of near-bed flow by the tubes, are responsible for lowering erosion thresholds in this system. (Author's abstract)
W87-07949

ASBESTOS FIBERS AND TRACE METALS IN THE BLOOD OF CATTLE GRAZING IN FIELDS INUNDATED BY ASBESTOS-RICH SEDIMENTS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W87-07987

TURBIDITY CURRENTS AND SUBMARINE CHANNEL FORMATION IN RUPERT INLET, BRITISH COLUMBIA: 1. SURGE OBSERVATIONS,
Memorial Univ. of Newfoundland, St. John's. Dept. of Physics.
A. E. Hay.
Journal of Geophysical Research (C) JGRCEY, Vol. 92, No. 3, p 2875-2881, March 1987. 6 fig, 22 ref. NSERC (Canada) Grants A8446 and G0208.

Descriptors: *Sediment transport, *Turbidity currents, *Density currents, *Submarine canyons, *Turbidity, *Hydrodynamics, *Submarine channels, *Rupert Inlet, *Currents, *Acoustic backscatter, *Mine wastes, Discharge, Density, Flow, Surges, Estimating, Waves, Velocity.

Acoustic backscatter images obtained at 107 and 200 kHz of surge-type turbidity currents resulting from mine tailing discharge are presented. Excess densities in the head of the order of 100 kg/cu m are estimated from differences in acoustic backscatter intensity and in the amplitude of the bottom-reflected signal. These excess densities are comparable to estimates based on surge height and speed, the speed being determined by assuming a universal head shape. Unlike gravity current surges from an impulsively started steady source, the surge-type turbidity flows consist of a high concentration slug of short duration followed by a longer-lived wake in which sediment concentrations are lower by 2-3 orders of magnitude. The profile of the high concentration slug resembles those for density slugs on small bottom slopes obtained in laboratory experiments. Discrete scatterers, probably fish, are observed to avoid the surges. (See also W87-08092) (Author's abstract)
W87-08091

SEDIMENT REMOVAL,
Pacific Northwest Environmental Research Lab., Corvallis, OR.
S. A. Peterson.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-236397. Price codes: A07 in paper copy, A01 in microfiche. EPA Report No. EPA-600/D-84-207, August 1984. 140 p, 23 fig, 8 tab, 97 ref.

Descriptors: *Sediment control, *Sediment removal, *Lake sediments, *Lake management, Dredging, Cost analysis, Sedimentation, Sediment transport.

When properly conducted, sediment removal is an effective lake management technique. This report describes: (1) purposes of sediment removal; (2) environmental concerns; (3) appropriate depth of sediment removal; (4) sediment removal techniques; (5) suitable lake conditions; (6) dredge selection and disposal area design; (7) exemplary case histories; and (8) costs. There are four major reasons for sediment removal from a lake: deepening, limitation of nutrient recycling, reduction of macrophyte nuisances, and the removal of sedimented toxic substances. Environmental concerns associated with lake sediment removal appear to be less negative than might be expected. Another potential impact is the effect dredged material has on the area where it is disposed. There is little doubt that

dredging can be a successful lake restoration technique if there is a thorough pre-implementation evaluation of the lake setting, if proper equipment is selected, if the disposal areas are designed for end of treatment effectiveness and if the dredging is conducted by conscientious and competent operators. Successful examples of both surface sediment skimming and deep (6 to 8 m) dredging can be cited. Thorough pre-implementation evaluation is the most important aspect of the project. (Author's abstract)
W87-08226

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART I: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-08229

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART II: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-08230

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART III: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-08231

BEDFORM-GENERATED CONVECTIVE TRANSPORT IN BOTTOM SEDIMENT,
Louisiana State Univ., Baton Rouge. Hazardous Waste Research Center.
For primary bibliographic entry see Field 5B.
W87-08254

ANDEKALELA WATER INTAKE CHARACTERISTICS FOR EXCLUDING SEDIMENTS (CARACTERISTIQUES DE LA PRISE D'EAU A ANDEKALELA POUR L'EXCLUSION DES SEDIMENTS),
La Salle Ltd. (Quebec). Lab. d'Hydraulique.
For primary bibliographic entry see Field 8A.
W87-08279

USER'S MANUAL FOR THE INSTREAM SEDIMENT-CONTAMINANT TRANSPORT MODEL SERATRA,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W87-08364

MOUNT ST. HELENS RECOVERY OPERATIONS,
Army Engineer District, Portland, OR.
R. E. Willis.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 208-217, 6 fig.

Descriptors: *Mudflows, *Mud, *Dredging, *Volcanoes, Rivers, River basins, Watersheds, Mt. St. Helens, Columbia River, Toutle River, Cowlitz River.

The emergency situation that existed and the recovery measures implemented by the Portland District of the Corps of Engineers following the eruption of Mt. St. Helens is described. The eruption on May 18, 1980 is outlined and the initial damage to the surrounding area is detailed. The blast and resultant mudflows seriously impacted the river basins of the Toutle, Cowlitz, and Columbia Rivers. The debris and mud avalanche left massive deposits in the Toutle River drainage. This deposit extended down the upper reach of the river for a distance of 17 river miles. Mudflows that followed the eruption carried material which deposited in the Toutle, Cowlitz and Columbia Rivers. Approximately 50 million cu yds of sediment was deposited into 21 miles of the Cowlitz River, and approximately 45 million cu yds in the Columbia River near the mouth of the Cowlitz River. Clean-up operations of these areas are discussed. (See also W87-08365) (Halterman-PTT)
W87-08387

TREND DETERMINATION OF POLLUTION LOAD AT DIFFERENT DISCHARGES BY THE EXAMPLE OF HEAVY METAL CONCENTRATIONS IN SUSPENDED SEDIMENTS (TRENDERMITTLUNG BEI UNTERSCHIEDLICHEN ABFLUESSEN AM BEISPIEL DER SCHWERMETALLGEHALTE VON SCHWEBSTOFFEN),
Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W87-08525

RELEVANCE OF CONTAMINATED SEDIMENT STUDIES IN THE GREAT LAKES TO POLLUTION ASSESSMENT AND CONTROL IN THE MEDITERRANEAN SEA,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5G.
W87-08569

2K. Chemical Processes

INVESTIGATION OF A CHEMILUMINESCENT SYSTEM FOR THE DETERMINATION OF AMMONIA BY FLOW-INJECTION ANALYSIS,
Michigan State Univ., East Lansing. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W87-07619

SPECIATION OF MANGANESE IN FRESH WATER - I: USE OF EPR STUDIES,
Queensland Univ., Brisbane (Australia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W87-07625

EXTRACTION AND PRECONCENTRATION OF SELENIUM FROM AQUEOUS SOLUTIONS AND ITS DETERMINATION IN WATER AND HAIR SAMPLES BY ATOMIC-ABSORPTION SPECTROPHOTOMETRY,
King Abdulaziz Univ., Jeddah (Saudi Arabia). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5A.
W87-07626

GEOHYDROLOGY AND HYDROCHEMISTRY OF AQUIFERS IN CRETACEOUS ROCKS, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W87-07759

AVAILABILITY AND QUALITY OF WATER FROM THE DAKOTA AQUIFER, NORTHWEST IOWA,
For primary bibliographic entry see Field 2F.
W87-07763

EVOLUTION OF FORMATION FLUIDS IN THE 'J' SANDSTONE, DENVER BASIN, COLORADO,
Exxon Co. USA, Houston, TX. East Central Exploration Div.
For primary bibliographic entry see Field 2F.
W87-07767

HYDROCHEMISTRY OF LOWER CRETACEOUS SANDSTONE AQUIFERS, NORTHERN GREAT PLAINS,
Geological Survey, Rapid City, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W87-07778

HYDROGEOLOGY AND DEVELOPMENT OF THE DAKOTA AQUIFER IN SOUTHWEST KANSAS,
Southwest Kansas Groundwater Management District No. 3, Garden City.
For primary bibliographic entry see Field 2F.
W87-07779

DAKOTA AQUIFERS IN EASTERN NEBRASKA, ASPECTS OF WATER QUALITY AND USE,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 2F.
W87-07780

GEOHYDROLOGY AND HYDROCHEMISTRY OF THE DAKOTA AQUIFER, CENTRAL UNITED STATES,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W87-07781

GAS CHROMATOGRAPHIC MEASUREMENT OF NITROGEN REMOVAL ACTIVITY BELOW THE MARSHY SOILS IN THE FEDERAL REPUBLIC OF GERMANY THROUGH A DRAINAGE TUBE (MESSUNG DER DENITRIFIKATIONS-AKTIVITAT VON DRAINIERTEN NIEDERMOORBODEN DER DDR MIT HILFE DER GASCHROMATOGRAPHIE),
Institute fuer Duengungsforschung Leipzig-Potsdam, Leipzig (German D.R.).
For primary bibliographic entry see Field 2G.
W87-07797

ENVIRONMENTALLY SIGNIFICANT PHOTOCHEMISTRY OF CHLORINATED BENZENES AND THEIR DERIVATIVES IN AQUATIC SYSTEMS,
Manitoba Univ., Winnipeg. Pesticide Research Lab.
For primary bibliographic entry see Field 5B.
W87-07807

EFFECT OF AMBIENT OXYGEN CONCENTRATION ON MEASUREMENTS OF SEDIMENT OXYGEN CONSUMPTION,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 7B.
W87-07872

SEDIMENT DIATOM AND METAL STRATIGRAPHY FROM ROCKY MOUNTAIN LAKES WITH SPECIAL REFERENCE TO ATMOSPHERIC DEPOSITION,
Colorado State Univ., Fort Collins. Natural Resources Ecology Lab.
For primary bibliographic entry see Field 5B.
W87-07873

INFLUENCE OF WATER HARDNESS, PH, AND ALKALINITY ON THE MECHANISMS OF COPPER TOXICITY IN JUVENILE RAINBOW TROUT, SALMO GAIRDNERI,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-07879

LOSS OF LAMPRICIDES BY ADSORPTION ON BOTTOM SEDIMENTS,
National Fishery Research Lab., La Crosse, WI.
For primary bibliographic entry see Field 8I.

W87-07882

SIMPLE METHOD OF MEASURING SESTON RESPIRATION IN OLIGOTROPHIC LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-07887

RAPID METHOD FOR ESTIMATING WEIGHTED SOIL SALINITY FROM APPARENT SOIL ELECTRICAL CONDUCTIVITY MEASURED WITH AN ABOVEGROUND ELECTROMAGNETIC INDUCTION METER,
Missouri Univ.-Columbia. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W87-07912

COMPARISON OF MECHANISMS ENHANCING BIODEGRADABILITY OF REFRACTORY LAKE WATER CONSTITUENTS,
Konstanz Univ. (Germany, F.R.). Limnological Inst.
For primary bibliographic entry see Field 2H.
W87-07947

DECOMPOSITION OF 14CLABELED ORGANIC SUBSTANCES IN MARINE SEDIMENTS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
S. M. Henrichs, and A. P. Doyle.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 765-778, July 1986. 5 fig, 5 tab, 40 ref.
NSF Grants OCE 82-14537 and OCE 84-15557.

Descriptors: *Decomposition, *Organic compounds, *Marine sediments, *Marine environment, *Carbon radioisotopes, *Chemical properties, *Isotopic tracers, Sediments, Organic carbon, Organic matter, Particulate matter, Pore water, Simulation, Interfaces, Sediment-water interfaces, Diatoms, Chrysophyta, Algae, Marine algae, Polymers, Model studies, Accumulation, Chemical reactions, Chemical reduction, Tracers, Nitrates, Sulfates, Environment.

The depth variation of total organic carbon (TOC), organic matter composition, and porewater composition in marine sediments suggests that different components of the organic matter undergo decomposition at widely different rates. The decomposition of 14C-labeled organic substances was followed in sediment microcosms in the laboratory. The substances used were chosen to simulate a portion of material settling to the sediment-water interface (a marine diatom) or hypothesized components of refractory sediment organic matter (melanoidins and a bacterial polymer). The microcosms were found to be good models of the sediment-water interface in terms of how well they mimicked sediment decomposition rates and processes. The decomposition of the labeled material and the natural sediment TOC were monitored over one month: the water overlying the sediment remained toxic, and net consumption of nitrate was small. There was no detectable sulfate reduction. The algae and the bacterial polymer were decomposed on average nine times faster than the melanoidins and 90 times faster than the natural sediment TOC. The soluble fraction of the algae was decomposed more rapidly than the particulate material. (Author's abstract)
W87-07948

SIMULTANEOUS PHOTOREDUCTION AND MICROBIAL OXIDATION OF IRON IN A STREAM IN THE NEW JERSEY PINELANDS,
Rutgers - The State Univ., New Brunswick, NJ. Div. of Pinelands Research.
For primary bibliographic entry see Field 2E.
W87-07953

PH OF ESTUARINE WATERS,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
F. J. Millero.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 839-847, July 1986. 4 fig, 7 tab, 28 ref.

Descriptors: *Estuaries, *Analytical methods, *Hydrogen ion concentration, *Estuarine environment, *Chemical properties, *Salinity, *Seawater, Environment, Kinetics, Acidity, Temperature, Water temperature.

The emf measurements for TRIS buffer in seawater have been used to define buffer solutions that can be used to determine the pH on a free or total proton scale for estuarine waters. The pH is related to the stoichiometric dissociation constant (K*) of TRISH(+), the concentration of buffer (mTRIS), and salinity (S) by pH = pK* + (aS + b.S squared)mTRIS where a = - 0.0000973 and b = 0.00006988. The values of pK* were fit to equations of the form pK* = A/T + B + C log T where A, B, and C are functions of salinity and T is the absolute temperature. An electrode system with liquid junction was used to measure these buffers to compare the various pH scales. The results are tabulated and can be used to examine the use of a buffer at fixed salinity to study an entire estuarine system. It is concluded that for salinities between 40 and 5 any buffer at a fixed salinity can be used (the best being S = 15). At salinities below 5.0, a series of dilute buffers should be used for accurate work to account for the large changes due to variations in activity coefficient and liquid junctions. (Author's abstract)
W87-07954

FERROUS IRON AND PHOTOTROPHY AS ALTERNATIVE SINKS FOR SULPHIDE IN THE ANOXIC HYPOLIMNIA OF TWO ADJACENT LAKES,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 2H.
W87-07962

STABILITY SPECTRA FOR THE DESCRIPTION OF COPPER-HUMIC COMPLEXES: A FLUORESCENCE QUENCH STUDY,
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
For primary bibliographic entry see Field 5A.
W87-07985

FLOW-INJECTION SPECTROPHOTOMETRIC DETERMINATION OF ALUMINIUM IN WATER WITH PYROCATECHOL VIOLET,
Norsk Inst. for Skogforskning, Aas.
For primary bibliographic entry see Field 5A.
W87-08017

DETERMINATION OF TRACE METALS IN SEDIMENT STANDARD REFERENCE MATERIALS BY GRAPHITE-FURNACE ATOMIC ABSORPTION SPECTROMETRY WITH A STABILIZED TEMPERATURE PLATFORM,
Ente Nazionale per l'Energie, Piacenza (Italy). Lab. Centrale.
M. Bettinelli, N. Pastorelli, and U. Baroni.
Analytica Chimica Acta ACACAM, Vol. 185, p 109-117, July 1986. 5 tab, 23 ref.

Descriptors: *Analytical methods, *Trace metals, *Sediments, *Atomic absorption spectroscopy, *Chemical analysis, Pollutant identification, Spectroscopy, Arsenic, Beryllium, Cadmium, Cobalt, Chromium, Copper, Manganese, Molybdenum, Nickel, Lead, Vanadium, Zinc, Marine sediments, Lake sediments, Reagents, Calibration, Standard deviation, Spectrometers, Heavy metals, Soil analysis, Sample preparation.

Trace elements (As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, V, Zn) in NBS 1645 (river sediment), NBS 1646 (estuarine sediment), MESS-1 and BCSS-1 (marine sediments), IAEA SL-1 (lake sediment) and IAEA Soil-5 are determined by graphite furnace atomic absorption spectrometry with the L'vov platform. The samples (ca. 0.25 g) are dissolved in a mixture of nitric, perchloric, and hydrofluoric acids in a PTFE bomb. Results based on direct calibration with simple aqueous solutions are in good agreement with those obtained by the method of standard additions and with recommended values. The relative standard deviations are generally 5-10%. Chromium determinations are also evaluated by inductively-coupled plasma/atomic emission spectrometry. Results reveal good agreement between chromium recoveries obtained by the two measurement techniques and also between acid dissolution and fusion procedures. Quantitative dissolution and recovery of chromium in all sediments analyzed is evident, indicating that complete dissolution of chromium-bearing minerals was achieved. It is concluded that the technique is simple and reliable. Direct calibration can be used, so that the method of standard additions is unnecessary. (Doria-PTT)
W87-08018

EFFICIENCY OF CELLEX-P FOR THE PRECONCENTRATION OF LEAD AND OTHER TRACE METALS FROM WATERS,
Warsaw Univ. (Poland). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W87-08019

DETERMINATION OF CADMIUM IN ENVIRONMENTAL MATERIALS BY FAST NEUTRON ACTIVATION ANALYSIS,
Ghent Rijksuniversiteit (Belgium). Inst. voor Nukleaire Wetenschappen.
For primary bibliographic entry see Field 5A.
W87-08020

DIFFERENTIAL-PULSE ANODIC VOLTAMMETRIC DETERMINATION OF DISSOLVED AND ADSORBED PHOSPHATE IN TURBID NATURAL WATERS,
Hokkaido Univ., Hakodate (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W87-08021

LEAD CONCENTRATIONS IN SOIL, SEDIMENT AND CLAM SAMPLES FROM THE PUNGO RIVER PEATLAND AREA OF NORTH CAROLINA, USA,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5B.
W87-08058

POTENTIAL FOR NITROSAMINE FORMATION IN SEVEN FISHERY CHEMICALS,
National Fishery Research Lab., La Crosse, WI.
For primary bibliographic entry see Field 5B.
W87-08116

SOLUTE TRANSPORT WITH EQUILIBRIUM AQUEOUS COMPLEXATION AND EITHER SORPTION OR ION EXCHANGE: SIMULATION METHODOLOGY AND APPLICATIONS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W87-08122

CHLORINATION BYPRODUCTS OF ARABIAN GULF SEAWATER,
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
For primary bibliographic entry see Field 5F.
W87-08261

GEOMETRIC MODELING OF DISSOLUTION KINETICS: APPLICATION TO APATITE,
Northwestern Univ., Evanston, IL. Dept. of Geological Sciences.
A. B. Hull, and J. R. Hull.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 707-714, April 1987. 3 fig, 4 tab, 38 ref, append.
DOE Contract W-31-109-Eng-38.

Descriptors: *Geochemistry, *Weathering, *Water chemistry, *Data interpretation, *Dissolution kinetics, *Model studies, *Apatite, *Aqueous solutions, Surface geometry, Kinetics, Solutes, Solutions, Dissolution.

Particle surface geometry is important in determining the rate of dissolution in aqueous systems.

Simplified models of dissolution kinetics that incorporate critical aspects of surface geometry can be formulated using a small number of parameters. For any dissolution model a chi-squared minimization technique can be used to determine solubilities, rate constants, and other model parameters from standard time versus concentration dissolution data. Using this technique to determine parameter values for each model, geometric models described better than any previous model a wide variety of kinetic data for the dissolution of apatite. (Author's abstract)
W87-08348

APPLIED ENVIRONMENTAL GEOCHEMISTRY.
Academic Press, London. 1983. Academic Press Geology Series. 501 p. Edited by Iain Thornton.

Descriptors: *Geochemistry, *Water pollution sources, *Fate of pollutants, *Metals, *Water quality, Heavy metals, Trace elements, Geological mapping, Mineral industry, Pollutant identification, Accumulation, Bioaccumulation, Sediments, Chemical reactions.

Major contributions to the study of environmental geochemistry and pollution are collected in this book, which emphasizes applied aspects. Chapters concerning water quality include the principles of environmental geochemistry, regional geochemical mapping and its application to environmental studies, analytical methods, geochemistry and water quality, assessment of metal pollution in rivers and estuaries, and heavy metal contamination from base metal mining and smelting. (See also W87-08354 thru W87-08359) (Cassar-PTT)
W87-08353

PRINCIPLES OF ENVIRONMENTAL GEOCHEMISTRY,
Institute of Geological Sciences, London (England). Metalliferous Minerals and Applied Geochemistry Unit.
J. A. Plant, and R. Raiswell.
In: Applied Environmental Geochemistry, Academic Press, London. 1983. p 1-39, 8 fig, 16 tab, 27 ref.

Descriptors: *Geochemistry, *Water pollution sources, *Trace elements, *Metals, Soil types, Geological mapping, Heavy metals, Rocks, Igneous rocks, Metamorphic rocks, Sedimentary rocks, Aquifers, Weathering, Oxidation-reduction potential, Hydrogen ion concentration, Surface water, Colloids, Organic matter, United Kingdom, Maps.

Levels of trace elements and, to a lesser extent, levels of major elements, cannot be reliably predicted using geological maps. An understanding of chemical and biological availability of trace elements requires knowledge of soil type, drainage conditions, redox potential/pH, and vegetation. In humid, temperate climates a broad distinction in geochemical environment may be drawn between (1) areas underlain by impervious, crystalline rocks and characterized by rapid rates of runoff and (2) areas underlain by permeable sedimentary rocks. In areas of the former type, surface conditions are characterized by low redox potential and pH, low levels of major cations and anions in water, increased levels of heavy metals, and the presence of colloidal and dissolved organic substances capable of adsorption and complexation. In areas of the second type agricultural soils and surface waters contain calcium and bicarbonate. Redox potential, pH, and levels of major cations and anions are generally high. Levels of organic acids and heavy metals bound by organic matter are low, but available levels of Mo and Se may be high. Where water supplies are drawn from deep aquifers, the concentration of trace elements depend on chemical equilibria, speciation, and solubility rather than the nature of the host rock or man's influence. Geochemical maps are most applicable to studies of trace elements and are most useful in areas with impervious underlying rock. (See also W87-08353) (Cassar-PTT)
W87-08354

REGIONAL GEOCHEMICAL MAPPING AND ITS APPLICATION TO ENVIRONMENTAL STUDIES,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
R. J. Howarth, and I. Thornton.
IN: Applied Environmental Geochemistry, Academic Press, London. 1983. p 41-73, 15 fig, 1 tab, 2 plates, 87 ref.

Descriptors: *Geochemistry, *Maps, *Trace elements, Geological mapping, United Kingdom, Metals, Heavy metals, Soil types, Sediments, Vegetation, Lead, Molybdenum, Nickel, Applied Geochemistry Research Group, Imperial College, Institute of Geological Sciences, Agriculture, Water pollution sources, Mineral industry, Public health, Water quality.

Regional geochemical maps for the United Kingdom are available from the Applied Geochemistry Research Group, Imperial College, and Institute of Geological Sciences. Most maps include on the order of 15-25 elements. These maps have helped recognize associations between groups of trace elements in stream sediments, soils, and vegetation. For example, soil overlying carboniferous black shale of marine origin contains excess levels of Mo, which produces induced Cu deficiency in grazing cattle. Soils in metal mining areas are generally contaminated with Pb, Zn, Cd, Sn, and As. These maps may also be useful in water quality assessment, medicine and public health, agriculture, protection of shellfish, mineral exploration, and determination of the source of soil cover. (See also W87-08353) (Cassar-PTT)
W87-08355

GEOCHEMISTRY AND WATER QUALITY,
Kansas Univ., Lawrence. Dept. of Geology.
E. E. Angino.
In: Applied Environmental Geochemistry, Academic Press, London. 1983. p 171-199, 5 tab, 42 ref.

Descriptors: *Geochemistry, *Water quality, *Chemical reactions, Hardness, Radioisotopes, Equilibrium, Solubility, Carbon dioxide, Calcium carbonate, Adsorption, Colloids, Clays, Water pollution sources, Climates, Biological effects, Microbiology, Weathering, Precipitation, Drinking water, Water treatment, Water distribution, Water storage.

This paper centers on some of the effects that chemical reactions and processes have on the geochemistry of water destined for various uses. Water hardness is primarily the result of interaction between water and the geological formations containing it or over which the water flows. Alkaline earth metals, principally calcium and magnesium, are responsible for water hardness, which is described by five scales (international and those from several individual countries). Radionuclides in water are of three types: naturally occurring (C12, K40, U238, and Th232), daughter products from heavy nuclides, and anthropogenic fission and transmutation products. Chemical reactions in natural water systems are of two types: those which commonly reach chemical equilibrium and those which have a barrier to reaching equilibrium. With respect to solubility, which is usually discussed in terms of chemical equilibrium, most reactions of water with surrounding substances are heterogeneous (liquid with rocks or soil). The three categories of reactions at interfaces are gas-liquid (carbon dioxide exchange), liquid-solid (weathering), and adsorption-desorption (suspended solids in water). Other factors influencing water quality are clays, climate, biological effects, microbiological effects, solute source, and man's influence. Water quality is also affected by treatment, distribution, and storage. (See also W87-08353) (Cassar-PTT)
W87-08357

IDENTIFICATION OF RECENT CALCITE PRECIPITATION IN SOIL WITH THE HELP OF ISOTOPE INVESTIGATIONS (NACHWEIS VON CARBONATAUSFAELLUNGEN IM BODEN MIT HILFE VON ISOTOPENUNTERSUCHUNGEN),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
For primary bibliographic entry see Field 2G.
W87-08528

2L. Estuaries

PETERSEN'S BENTHIC STATIONS REVISITED. II. IS THE OSLOFJORD AND EASTERN SKAGERRAK ENRICHED,
Havfiskelaboratoriet, Lysekil (Sweden).
R. Rosenberg, J. S. Gray, A. B. Josefson, and T. H. Pearson.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 105, No. 2/3, p 219-251, March 1987. 10 fig, 9 tab, 33 ref. National Swedish Environment Protection Board Contract 5312015-0.

Descriptors: *Enrichment, *Macrobenthos, *Comparison studies, *Skagerrak, *Fjords, *Oslofjord, *Biomass, *Limnology, *Surveys, Polychaetes, Echinoderms, Species composition, Seasonal variation, Fjords, Sweden.

In summer 1985, 23 of the stations established in 1914 by C.G.J. Petersen in the northern Skagerrak and the Oslofjord, were revisited to compare the present state of the macrobenthic assemblages with the previous condition. The methods used were similar to those of the original survey. The total benthic biomass was significantly higher in 1985 by, on average, a factor of 1.8 over the whole area. Most of this change was due to a highly significant increase of worms, notably polychaetes, and a significant increase of ophiuroid and echinoid echinoderms. Similarity values in terms of biomass suggested that community composition had changed considerably over the 70-yr period, in particular in the inner and central Oslofjord (11% similarity) but also in the outer Oslofjord and the Skagerrak (33% similarity). There was no difference in the comparative size of individual organisms over the period. The observed increase in biomass is greater than the increase along the Swedish Skagerrak coast observed in the late 1970s, and well beyond the observed limits of annual variability in such areas. Different causes for the observed changes are discussed and it is suggested that a general organic enrichment has taken place in the Oslofjord. (Author's abstract)
W87-07630

NAKDONG ESTUARY BARRAGE AND RECLAMATION PROJECT: PRELIMINARY RESULTS OF THE BOTANICAL, MACROZOOBENTHIC AND ORNITHOLOGICAL STUDIES,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
G. Doornbos, A. M. Groenendijk, and Y. W. Jo.
Biological Conservation BICOBK, Vol. 38, No. 2, p 115-142, October 1986. 5 fig, 4 tab, 37 ref.

Descriptors: *Estuaries, *Estuarine environment, *Benthic environment, Benthic fauna, Birds, Waterfowl, Vegetation, Wetlands, Marshes, Primary productivity, Secondary productivity, Crustaceans, Molluscs, Polychaetes, South Korea, Nakdong River estuary.

A barrage is under construction at the mouth of the Nakdong River, Republic of Korea, to prevent saline water from reaching the lower reaches of the river basin during the dry season. The area is a main passage and wintering ground for wading birds and waterfowl in Korea. Studies on the vegetation, macrobenthos and birds in the river delta have been conducted. The total biomass of Scirpus triqueter, the estuary's most important foodplant for waterfowl (mainly for swans) was assessed at approximately 38.3 tons dry wt. over 40 ha. Only the roots and rhizomes (9.6 tons dry wt) would be consumed by the birds. Aquatic weeds in the nearby freshwater Jukrim branch provided another food source (5.8 tons dry wt on 9 ha). The wintering waterfowl also used other feeding areas, such as farmland and freshwater impoundments. Almost all herbivorous birds participated in nightly feeding migrations. At 12 stations in 20.5 sq km of intertidal flats, a total of 40 macrozoobenthic spe-

cies were found: 19 species of crustaceans, 11 molluscs, and 10 polychaetes. The average biomass for all stations was 14.6 g ash free dry wt per 0.1 sq m (range 3.1 to 51.9): 9.5 g of molluscs, 2.9 g of crustaceans, and 2.2 g of polychaetes. The bivalve Corbicula japonica was dominant, contributing 4.4 g of the total biomass. During three censuses, 10,000 waders and 25,000-30,000 waterfowl were counted. Two species, the ruff and canvasback, were heretofore unrecorded in Korea. Among nonpasserines, the widgeon (peak 6800) and the dunlin (peak 9100) were most numerous while ducks, as a group, were most dominant, comprising 64% of the total. At the beginning of October wader density was 5.2 birds/ha of intertidal area exposed at low tide. (Authors' abstract)
W87-07814

VARIATION IN SHELL CHEMISTRY OF TERRESTRIAL GASTROPODS (CERION INCANUM, CERION UVA, AND TUDORA MACULATA) FROM THE FLORIDA KEYS AND BONAIRE,
Brock Univ., St. Catharines (Ontario). Dept. of Geological Sciences.
U. Brand, L. Wassenaar, and J. Kanip.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 11, p 2399-2404, November 1986. 7 fig, 3 tab, 20 ref.

Descriptors: *Gastropods, *Environmental effects, *Chemical composition, Mollusks, Strontium, Magnesium, Sodium, Florida Keys, Bonaire, Mineralogy.

This study examined the intraspecific and interspecific differences in microstructures, mineralogy, and minor- and trace-element composition of terrestrial gastropods from the Florida Keys and Bonaire, and compared their shell chemistry with that of marine and freshwater gastropods. Cerion and Tudora from the Florida Keys and Bonaire secrete shells composed of prismatic, homogeneous, and crossed-lamellar aragonitic layers. Strontium, magnesium, and sodium contents of shells of Cerion from Sugarloaf Key are greatly influenced by the marine waters that regularly inundate this island. In contrast, the concentrations of these elements in shells in Cerion from Windley Key are controlled by both freshwater, in the form of precipitation, and seawater seeping through the rock into the quarry. Strontium and, to a lesser degree, magnesium are deficient and sodium is relatively high in shells of Cerion and Tudora from dried-out ponds on Bonaire. As with the other elements, concentrations of iron, manganese, and nickel in the shells of the studied gastropods are also controlled by the type and amount of water present in each local environment. (Authors' abstract)
W87-07825

USE OF MARINE ELECTROMAGNETIC CONDUCTIVITY AS A TOOL IN HYDROGEOLOGIC INVESTIGATIONS,
Geological Survey, Trenton, NJ.
For primary bibliographic entry see Field 7A.
W87-07850

TERRESTRIAL AND FRESHWATER INVERTEBRATES IN THE NEUSTON OF THE BAY OF FUNDY, CANADA,
Guelph Univ. (Ontario). Dept. of Zoology.
A. Locke, and S. Corey.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 7, p 1535-1541, July 1986. 9 fig, 1 tab, 25 ref.

Descriptors: *Invertebrates, *Limnology, *Bay of Fundy, *Aquatic insects, *Neuston, *Species composition, *Population density, Seasonal variation, Mites, Distribution, Annual distribution, Taxonomy, Sampling, Biological sampling, Density, Caddisflies, Dragonflies, Growth stages, Larval growth stage, Mature growth stage.

More than 106 families of insects representing 12 orders, as well as spiders, mites, and millipedes, were collected in the neuston of the Bay of Fundy in spring, summer, and autumn (1979-1983). Collections were made using a neuston net towed from a research vessel. Homoptera, Dipters, and Hymenoptera were dominant in number of families and/or number of individuals. Odonata, Orthoptera, Psocoptera, Thysanoptera, Hemiptera, Neuroptera, Coleoptera, Trichoptera, and Lepidoptera were also present. Seasonal and annual variations in taxonomic composition and in abundance were considerable. Insect diversity and abundance were minimal in spring, reached a maximum with ubiquitous distribution in summer, and decreased in autumn. It is concluded that the abundant detritus of terrestrial and fluvial origin in the neuston, especially in summer, may be a potentially important food source for surface-feeding animals. (Author's abstract)
W87-07903

NUTRIENT CYCLING STUDIES IN CARMARTHEN BAY: PHYTOPLANKTON PRODUCTION, NITROGEN ASSIMILATION AND REGENERATION,
Institute for Marine Environmental Research, Plymouth (England).
N. J. P. Owens, R. F. C. Mantoura, P. H. Burkill, R. J. M. Howland, and A. J. Pomroy.
Marine Biology MBIOAJ, Vol. 93, No. 3, p 329-342, December 1986. 7 fig, 6 tab, 41 ref. U.K. Dept. of Environment Research Contract DGR 480/48.

Descriptors: *Limnology, *Cycling nutrients, *Carmarthen Bay, Wales, *Phytoplankton, *Nitrogen cycle, *Bioaccumulation, *Regeneration, *Primary productivity, Nutrients, Accumulation, Nitrogen, Productivity, Aquatic plants, Plankton, Chlorophyll, Distribution, Spatial distribution, Seasonal distribution, Nitrates, Biomass, Ammonium, Marine biology, Bays.

Results are presented from a series of five cruises (August 1979-January 1981) to examine rates of primary production, nitrogen assimilation, and regeneration in Carmarthen Bay, S. Wales. Chlorophyll, primary production, and regeneration were distributed irregularly throughout the bay, with the highest concentrations and rates being found around the shallow periphery. Nitrate was the dominant form of nitrogen assimilated by the phytoplankton, apart from periods of high biomass during the summer when ammonium assumed a more important role. The rates of ammonium regeneration from microheterotrophs were greater than the ammonium demand over much of the year, indicating that the bay was a net exporter of ammonium and was a physically dominated 'open' system. During the summer, the rates of ammonium regeneration and assimilation were similar, indicating efficient recycling of nutrients. (Author's abstract)
W87-07942

DETERMINATION OF PHOTOSYNTHETIC PIGMENT COMPOSITION IN AN INDIVIDUAL PHYTOPLANKTON CELL IN SEAS AND LAKES USING FLUORESCENCE MICROSCOPY; PROPERTIES OF THE FLUORESCENCE EMITTED FROM PICOPHYTOPLANKTON CELLS,
Mitsubishi-Kasei Inst. of Life Sciences, Tokyo (Japan).
For primary bibliographic entry see Field 7B.
W87-07943

PH OF ESTUARINE WATERS,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
For primary bibliographic entry see Field 2K.
W87-07954

NET PRIMARY PRODUCTION, DECOMPOSITION AND EXPORT OF SPARTINA ANGLICA ON A SUFFOLK SALT-MARSH,
Essex Univ., Colchester (England). Dept. of Biology.
D. Jackson, S. P. Long, and C. F. Mason.
Journal of Ecology JECOAB, Vol. 74, No. 3, p 647-662, September 1986. 5 fig, 4 tab, 29 ref.

Descriptors: *Limnology, *Primary productivity, *Decomposition, *Suffolk, England, *Export, *Spartina, *Salt marshes, *Seasonal variation, Marshes, Ecology, Root development, Roots, Growth, Marsh plants, Aquatic plants, Density, Flowering, Particulate matter, Environment, Estuarine environment, Biomass, Leaves, Carbon cycle, Biodegradation, Microbial degradation.

Annual net primary shoot productions (ANPPs) for Spartina anglica of 220 and 280 g C/sq m were recorded in 1979 and 1980, respectively, on a salt marsh in Suffolk, England. Root production was estimated at 180 and 230 g C/sq m/yr. Shoot turnover was about 2.1/yr, and periods of growth and senescence overlapped to a large degree. Only 5-10% of S. anglica stems reached flowering maturity. Total stem density was maximal in late summer, exceeding 2,000/sq m in September 1980. Live shoot biomass also reached a peak in late summer, exceeding 150 g C/sq m in both years. Production of leaves and stems was highest at the seaward edge of the salt marsh. The rate of decomposition of standing dead S. anglica was estimated using litter bags of differing mesh size, and two different methods of data analysis were compared; results were in reasonable agreement. A loss of dead material equivalent to 29-32% of ANPPs/yr was estimated due to microbes and microfauna, with an additional loss of 3% ANPPs/yr due to meiofauna. Approximately 15-20%/yr of ANPPs was exported from the site of production as particulate matter; of this, 70% entered the estuary and the remainder was removed to the strandline. (Author's abstract)
W87-07961

CHANGES IN THE COMPOSITION AND STANDING CROP OF SALT-MARSH COMMUNITIES IN RESPONSE TO THE REMOVAL OF A GRAZER,
Toronto Univ. (Ontario). Dept. of Botany.
D. R. Bazely, and R. L. Jefferies.
Journal of Ecology JECOAB, Vol. 74, No. 3, p 693-706, September 1986. 4 fig, 7 tab, 41 ref.

Descriptors: *Limnology, *Species composition, *Salt marshes, *Grazing, *Standing crops, *Litter, *Aquatic ecosystems, *Geese, *Marsh plants, Marshes, Organic matter, Ecology, Ecosystems, Waterfowl, Vegetation, Populations, Plant populations, Habitats, Food habits, Food chains, Accumulation, Manitoba.

Changes in species composition, live standing crop, and plant litter were measured in a salt marsh in Manitoba in the presence and absence of a grazer (the lesser snow goose). The composition of vegetation in exclosures changed rapidly. After five years, 16 species of higher plants were present in the oldest exclosure compared with six species in an adjacent (control) grazed area. New species which appeared in the exclosure were present in ungrazed areas elsewhere in the marsh, although the frequency of these species in the exclosures was different from that in ungrazed areas. The removal of geese led to extensive clonal growth of species which are unable to tolerate heavy grazing and trampling. Within a season, the standing crop of vegetation was highest in exclosures erected one or two years previously. Litter accumulated in exclosures. The ratio of maximum standing crop to litter fell from $> 4:1$ to $< 2:1$ as communities aged in the absence of grazing. Cessation of grazing leads to rapid changes in the structure and composition of the community. The vegetation within an exclosure was poorly grazed when the fence was removed after two years. (Author's abstract)
W87-07963

FACTORS CONTROLLING THE GROWTH FORM OF SPARTINA ALTERNIFLORA: FEEDBACKS BETWEEN ABOVE-GROUND PRODUCTION, SEDIMENT OXIDATION, NITROGEN AND SALINITY,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
B. L. Howes, J. W. H. Dacey, and D. D. Goehringer.
Journal of Ecology JECOAB, Vol. 74, No. 3, p 881-898, September 1986. 6 fig, 3 tab, 79 ref.

Descriptors: *Model studies, *Spartina, *Biomass, *Nitrogen, *Salinity, *Sediments, *Limnology,

*Oxidation, *Physiological ecology, *Plant growth, Interstitial water, Water exchange, Marsh plants, Marshes, Salt marshes,Chemical properties, New England, Prediction, Nutrients, Fertilization, Evapotranspiration, Drainage, Streams, Banks, Stream banks, Grasses, Vegetation, Ecology.

The relationship between above-ground biomass of Spartina alterniflora and sediment oxidation status (Eh), available ammonium concentration, and interstitial salinity was investigated at 21 sites in a New England salt marsh. Sediment Eh gave the best prediction of above-ground biomass. The relationship between sediment oxidation and above-ground production existed between years and marshes. Measurements in nitrogen-fertilized areas indicate that increasing plant production leads to more oxidized sediments. Sediment oxidation in vegetated sediments occurs via air entry, which was found to cause a rapid and significant rise in sediment oxidation potential. Air enters the sediment in response to water removal from the sediment by evapotranspiration in short grass zones and evapotranspiration and drainage on creek banks. The available data on the environmental controls of Spartina growth were used to construct a model consisting of a variety of feedbacks between plant production, available nitrogen, interstitial salinity, and sediment oxidation state mediated primarily through the rates and pathways of interstitial water exchange. (Author's abstract)
W87-07964

PRODUCTION, PREDATION, AND DECOMPOSITION IN A LOW-SALINITY HIBISCUS MARSH,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
D. R. Cahoon, and J. C. Stevenson.
Ecology ECOLAR, Vol. 67, No. 5, p 1341-1350, October 1986. 6 fig, 4 tab, 65 ref.

Descriptors: *Limnology, *Primary productivity, *Predation, *Decomposition, *Salinity, *Marshes, *Grazing, *Hibiscus, *Marsh plants, Productivity, Leaves, Aquatic plants, Ecology, Salt marshes, Standing crops, Mortality, Litter, Organic matter, Ecosystems, Insects, Roots, Export, Tides, Food chains, Biomass, Dynamics.

The rates of production, leaf grazing, and stem decomposition associated with Hibiscus moscheutos were quantified to contrast the ecology of this brackish herbaceous perennial with fresh and salt marsh species. Average net aerial primary production (NAPP) during 1978 and 1979 was slightly over 1200 g/sq m/yr, estimated by summing peak standing crop (49%), leaf mortality and litter production (36%), and losses to herbivores (15%). Three species of herbivorous insects were found to be important grazers. Herbivore consumption was far greater than previously reported in salt marsh systems and rivals that of terrestrial communities. The root:shoot ratio (2.3) is comparable to many fresh marsh species but lower than most high-salinity species. The decomposition rate of Hibiscus stem material was estimated to be on the order of 7-8 yr, or up to five times slower than stems and leaves of other typical brackish marsh species. The export potential of detritus from decaying stems is apparently minor because of this slow rate of decomposition combined with the diminished tidal action typical of Hibiscus-dominated marshes. It is suggested that this unusual marsh dominant differs from Spartina in salt marsh systems by nourishing a more robust grazing food chain and by not exporting significant quantities of detrital material. (Author's abstract)
W87-07976

COMPARATIVE PATHWAY ANALYSIS OF RADIOCESIUM IN THE HUDSON RIVER ESTUARY: ENVIRONMENTAL MEASUREMENTS AND REGULATORY DOSE ASSESSMENT MODELS,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
For primary bibliographic entry see Field 5B.
W87-07991

STUDY OF THE SUBSTRATE INFLUENCE ON THE FREE FATTY ACIDS PRODUCTION DURING GROWTHS OF MARINE BACTERIA ON DIFFERENT HYDROCARBONS,
Centre d'Oceanologie de Marseille (France).
For primary bibliographic entry see Field 5B.
W87-08002

PLANKTON RESPONSE FOLLOWING A SPRING UPWELLING EVENT IN THE RIA DE AROSA, SPAIN,
Skidaway Inst. of Oceanography, Savannah, GA.
R. B. Hanson, M. T. Alvarez-Ossorio, R. Cal, M. J. Campos, and M. Roman.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 101-113, September 1986. 13 fig, 4 tab, 37 ref.

Descriptors: *Upwelling, *Limnology, *Ecological effects, *Phytoplankton, *Aquatic bacteria, *Spain, *Growth rate, *Biomass, *Zooplankton, *Mussels, *Estuaries, Plankton, Aquatic plants, Bacteria, Dynamics, Mollusks, alinity, Chemical properties, Temperature, Water temperature, Physical properties, Bottom water, Productivity, Primary productivity, Chlorophyll a, Surface water, Distribution, Vertical distribution, Photosynthesis, Thermocline, Grazing, Aquaculture.

Phytoplankton and bacterioplankton growth dynamics, along with biomass and ingestion rates of zooplankton and mussels hung from rafts in the Ria de Arosa (Spain) were studied after a spring upwelling event. Upwelling of North Atlantic Central Water was confirmed by salinity, temperature, and nutrient properties of the bottom waters in the Ria and the positive upwelling index calculated for the study period. On March 11, 1983, primary production and chlorophyll a concentrations exceeded 30 mg C/cu m/h and 10 mg/cu m, respectively, in the surface waters. After the upwelling, primary production decreased to < 2 mg C/cu m/h. Bacterial growth dynamics were vertically separated from phytoplankton growth dynamics following the upwelling. The highest specific rate of bacterial production occurred below the depth of maximum photosynthesis and above the thermocline. The highest rates of bacterial production were < 10% of phytoplankton production. Zooplankton grazing experiments indicated an active selection of phytoplankton over bacteria and a sufficient grazing rate to crop the daily phytoplankton production. It is concluded that herbivorous zooplankton may sometimes compete for food with raft-mussel aquaculture in the Ria. (Author's abstract)
W87-08022

DIEL PERIODICITY OF NITROGEN AND CARBON ASSIMILATION IN FIVE SPECIES OF MARINE PHYTOPLANKTON: ACCURACY OF METHODOLOGY FOR PREDICTING N-ASSIMILATION RATES AND N/C COMPOSITION RATIOS,
Hawaii Univ., Honolulu. Dept. of Oceanography.
G. R. DiTullio, and E. A. Laws.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 123-132, September 1986. 3 fig, 4 tab, 46 ref.

Descriptors: *Limnology, *Diurnal distribution, *Nitrogen, *Carbon, *Bioaccumulation, *Phytoplankton, *Chemical composition, *Marine environment, *Nutrients, Distribution, Accumulation, Performance evaluation, Prediction, Plankton, Aquatic plants, Marine biology, Algae, Ammonium, Carbon radioisotopes, Radioisotopes, Protein, Growth rates, Particulate matter, Respiration, Dissolved solids, Organic matter, Environment.

Diel patterns of carbon and nitrogen assimilation were investigated in 5 taxonomically diverse species of unicellular algae grown in NH4(+)-limited cyclostats. Calculated 24 h average rates of N-assimilation based on 14C incorporation into protein overestimated the actual rate by an average of 24%. Overestimation of carbon assimilation by the 14C method (16%) accounted for most of the observed discrepancy in the estimation of N-assimilation rates. Estimates of actual N-assimilation rates were more accurate at high relative growth rates (104%) than at low relative growth rates (143%). The N/C assimilation ratio provided an accurate estimate 104% of the N/C composition ratio after a 12:12 L:D cycle. The percentage decrease in particulate 14C activity at night due to respiration was 105% greater than the predicted decrease estimated from the loss in particulate carbon concentration; dark respiration of carbon with an average specific activity equal to that of the inorganic carbon could not entirely account for this phenomenon. Excretion of dissolved organic carbon (DOC) during the photoperiod and uptake of low specific-activity DOC at night may have caused the decrease in specific activity of particulate 14C at night. (Author's abstract)
W87-08023

LATERAL VARIATION IN THE PRODUCTION AND FATE OF PHYTOPLANKTON IN A PARTIALLY STRATIFIED ESTUARY,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
T. C. Malone, W. M. Kemp, H. W. Ducklow, W. R. Boynton, and J. H. Tuttle.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 149-160, September 1986. 12 fig, 2 tab, 60 ref.

Descriptors: *Limnology, *Spatial distribution, *Aquatic productivity, *Phytoplankton, *Estuarine environment, *Population density, *Chesapeake Bay, *Seasonal variation, *Biomass, Distribution, Productivity, Plankton, Aquatic plants, Environment, Estuaries, Cycling nutrients, Organic matter, Density, Nutrients, Vertical distribution, Bays, Oxygen, Chlorophyll a, Bacteria, Marine bacteria, Eutrophication, Carbon cycle.

The high productivity of many estuaries is believed to result from both allochthonous nutrient inputs and autochthonous recycling of nutrients among producers and decomposers of organic matter. Time-dependent variations in density structure were documented along a transect normal to the main axis of Chesapeake Bay to investigate the mechanisms by which nutrients are recycled between sources and sinks. These variations influenced lateral distributions of dissolved inorganic nutrients, oxygen, chlorophyll a, and bacterioplankton and appeared to be responsible for high phytoplankton production over the flanks of the main channel relative to production over the channel. Absolute levels of bacterial abundance were among the highest reported, suggesting that bacteria are responsible for a large function of the carbon flux in the bay. Relations among phytoplankton production, bacterial abundance, and sediment trap collections indicate that variations in density structure reflect a transverse circulation which may explain how nutrients regenerated below the pycnocline are rapidly recycled into the euphotic zone above. This could be an important mechanism by which river-borne nutrient inputs during spring are coupled to high phytoplankton production during summer. (Author's abstract)
W87-08024

RELATIONSHIP BETWEEN PARTICULATE AND EXTRACELLULAR CARBON COMPOUNDS OF PHYTOPLANKTON PHOTOSYNTHESIS IN A TROPICAL ESTUARY,
National Inst. of Oceanography, Panaji (India).
M. S. Shailaja, and A. Pant.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 161-167, September 1986. 2 fig, 4 tab, 21 ref. DST Project 12 (13)/78-SERC.

Descriptors: *Limnology, *Organic compounds, *Particulate matter, *Carbon cycle, *Phytoplankton, *Photosynthesis, *Tropic zone, *Estuarine environment, *Seasonal variation, Environment, Estuaries, Climatic zones, Monsoons, Wind, Distribution patterns, Radioisotopes, Carbon radioisotopes, Light intensity, Species composition, Carbon, Proteins, Chemical analysis, Plankton, Aquatic plants.

The influence of seasonal environmental conditions on the formation of release of organic compounds by photosynthesizing phytoplankton was studied in a tropical estuary. Selected low-molecular-weight intermediates of the glycolate pathway (glycolic

acid, glycine, and serine) and intermediates of carbohydrate and protein synthesis (e.g., glucose, aspartic acid, and serine) were specifically analyzed for their presence in the cells and in cell exudates. The pattern of 14C fixation into the various intracellular compounds changed from pre-monsoon to monsoon depending on the quality and intensity of light available during the two seasons as well as on phytoplankton composition. Carbon was largely incorporated into the intracellular carbohydrate fraction during the pre-monsoon and into the protein fraction during the monsoon. Quantitative analysis of some selected low molecular weight compounds present in the intracellular photosynthate pool and extracellular exudate pool suggested that the release of organic compounds is governed mainly by the rate of their production. (Author's abstract)
W87-08025

TROPHIC INTERACTIONS BETWEEN HETEROTROPHIC PROTOZOA AND BACTERIOPLANKTON IN ESTUARINE WATER ANALYZED WITH SELECTIVE METABOLIC INHIBITORS,
Georgia Univ., Sapelo Island. Marine Inst.
B. F. Sherr, E. B. Sherr, T. L. Andrew, R. D. Fallon, and S. Y. Newell.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 169-179, September 1986. 5 fig, 5 tab, 54 ref. NSF Grant OCE-82-19866, NIH Grant BRSG 507 RR07025-21.

Descriptors: *Analytical methods, *Limnology, *Heterotrophic bacteria, *Ecology, *Protozoa, *Estuarine environment, *Metabolic inhibitors, *Salt marshes, *Grazing, *Food chains, Plankton, Zooplankton, Phytoplankton, Aquatic plants, Environment, Estuaries, Marshes, Seasonal variation, Density, Population density, Nitrogen, Nitrogen cycle, Nutrients, Cycling nutrients, Growth, Productivity, Aquatic animals.

In situ grazing rates of heterotrophic nanoplankton (HNAN) on bacterioplankton in a salt marsh estuary in Georgia were estimated using a selective metabolic inhibitor technique. Seasonal experiments with prokaryotic inhibitors showed a significant, positive relation between bacterial abundance and HNAN grazing rates. On average, only 40 to 45% of bacterioplankton production in the estuary appeared to be consumed by phagotrophic protozoa (< 20 microns). Eukaryotic inhibitor experiments suggested that protozoan grazing can have a positive feedback effect on bacterioplankton production, and that nitrogen regeneration by protozoa may be of particular importance to bacterial growth. Although eukaryotic inhibitors did not prove to be routinely useful to estimate protozoan grazing rates on bacterioplankton, they may contribute to understanding qualitative control mechanisms in the microbial food web. It is also suggested that feedback control effects should be explicitly included in any future modeling efforts. (Author's abstract)
W87-08026

CONSISTENCY OF SEASONAL CHANGES IN AN ESTUARINE FISH ASSEMBLAGE,
Murdoch Univ. (Western Australia). School of Environmental and Life Science.
I. C. Potter, P. N. Claridge, and R. M. Warwick.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 217-228, September 1986. 6 fig, 2 tab, 44 ref.

Descriptors: *Limnology, *Seasonal variation, *Estuarine environment, *Severn Estuary, *Species composition, *Fish populations, *Fish migration, *Distribution patterns, Environment, Density, Population density, Classification, Temperature, Water temperature, Salinity, Chemical properties, Physical properties, Powerplants, Migration, Species diversity, Growth stages, Fish, Ecological distribution.

Data on the abundance of all fish species collected at weekly intervals from the intake screens of the Oldbury-upon-Severn Power Station in the inner Severn Estuary (U.K.) between 1972 and 1977 were analyzed using classification and multi-dimensional scaling (MDS) ordination techniques. The results show that in each year the structure of the fish community in the shallows of the estuary underwent similar cyclical changes. These changes were largely attributable to a sequential immigration and emigration of different species, especially estuarine-dependent marine species, and were not driven directly by variations in water temperature, salinity or freshwater discharge from the river. However, comparisons between the data for years with the driest and wettest winters show that the pattern of change in faunal composition was modified under extreme environmental conditions. (Author's abstract)
W87-08027

MICROBENTHOS, MEIOBENTHOS AND FIDDLER CRABS: TROPHIC INTERACTIONS IN A TROPICAL MANGROVE SEDIMENT,
Transkei Univ., Umtata (South Africa). Dept. of Zoology.
A. H. Dye, and T. A. Lasiak.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 259-264, September 1986. 1 fig, 1 tab, 43 ref.

Descriptors: *Limnology, *Benthos, *Ecology, *Food chains, *Crabs, *Tropic zone, *Mangrove swamps, *Sediments, Crustaceans, Climatic zones, Swamps, Food habits, Algae, Tides, Density, Population density, Migration, Protozoa, Benthic fauna, Detritus, Organic matter, Aquatic animals, Environment, Estuarine environment, Bays, Queensland.

Aspects of the feeding ecology of the fiddler crabs Uca vocans and Uca polita from tropical mangroves were studied. Gut analysis revealed that microheterotrophs were the major food source for both species, although U. polita also ingested small numbers of microalgae. No evidence was found for the ingestion of meiobenthos. Based on measurements of feeding rate and mass of feeding pellets produced, it is estimated that the U. vocans population forages 43% of the sediment surface during a low-tide feeding period of 2 to 2.5 h; the corresponding figure for U. polita is 22%. Abundance of meiobenthos increased 2- to 5-fold when crabs were excluded from the sediment. It is suggested that avoidance by downward migration and/or competition for food resources may account for this difference. (Author's abstract)
W87-08028

INFLUENCE OF TEMPERATURE, SALINITY, AND OXYGEN ON THE CADMIUM BALANCE OF MUSSELS MYTILUS EDULIS,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
H. Fischer.
Marine Ecology Progress Series MESEDT, Vol. 32, No. 2/3, p 265-278, September 1986. 7 fig, 6 tab, 77 ref. UBA F and E Vorhaben Wasser 10607033.

Descriptors: *Limnology, *Temperature effects, *Salinity, *Cadmium, *Mussels, *Oxygen, *Mytilus, *Bioaccumulation, *Growth, *Bioindicators, Temperature, Water temperature, Chemical properties, Physical properties, Mollusks, Growth stages, Juvenile growth stage, Aquariums, Tissue analysis, Salts, Accumulation, Calcium, Heavy metals, Oxygen, Dissolved oxygen, Biological magnification, Indicators.

Juvenile mussels were cultivated in controlled flow-through aquaria to investigate the influence of environmental temperature, salinity, and dissolved oxygen on cadmium balance. Inverse relations between Cd concentration of soft tissues and physical condition of mussels were observed in response to temperature. Reducing salinity while keeping dissolved Cd constant increased the molar ratio of Cd and seawater salts. Accumulation of Cd in the soft tissues and of Ca in the shells of mussels was determined by Cd and Ca concentrations within the range of 1.5 to 3.0% salinity. Residues of Cd in mussels are therefore higher in samples from lower salinity. Below 1.5%, the Cd/shell-wt index is disproportionately higher, corresponding to reduced shell growth in lower salinities. Dissolved oxygen concentrations between 2.5 and 6.5 ml/l had no influence on the Cd balance of mussels. Experimental results were reproducible and corresponded to field observations, and modifications of growth and performance were in accordance with the literature. Lowest experimental temperature, salinity, and oxygen tested inhibited both growth of mussels and Cd uptake within a small laboratory gradient. Growth in the concerned environment is discussed as an essential aspect of research on metals and molluscs, and in relation to the mussel watch (bioindicator) concept. (Author's abstract)
W87-08029

PERIPHYTON AS MONITORS FOR HEAVY METAL POLLUTION IN THE CALCASIEU RIVER ESTUARY,
McNeese State Univ., Lake Charles, LA. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W87-08055

NUMERICAL SIMULATION OF FLOODING AND DRYING IN A DEPTH-AVERAGED TIDAL FLOW MODEL,
Bradford Univ. (England). Dept. of Civil Engineering and Structural Engineering.
R. A. Falconer, and P. H. Owens.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 83, Part 2, p 161-180, March 1987. 14 fig, 16 ref.

Descriptors: *Model studies, *Tidal currents, *Flooding, *Estuaries, *Numerical analysis, *Simulation, *Hydrodynamics, Prediction, Drying, Humber Estuary, Depth, Velocity, Field tests.

A refined numerical modelling scheme to simulate the flooding and drying of shallow estuarine reaches by repetitive tides is described. Interest has been focused on developing a technique which can be applied to relatively large grid space and time step models, and which may be particularly relevant to nested hydrodynamic modelling. Details are given of comparisons of water elevation predictions obtained for two different approaches in modelling flooding and drying, for an idealized one-dimesional estuary with a uniformly sloping bed and with extreme grid and time step sizes. As a result of these comparisons, a refined scheme which is particularly relevant to less time restrictive implicit models has been proposed. The proposed flooding and drying simulation technique has been applied to a two-dimesional coarse grid model of the Humber Estuary. The predicted water elevations and depth mean velocities have compared favorably with field measurements taken at four specific sites along the estuary, which would suggest that the technique is an improvement on an earlier scheme that gave unstable results for the Humber Estuary. (Author's abstract)
W87-08076

EVALUATING THE WETLAND RESOURCE,
Silsoe Coll. (England).
For primary bibliographic entry see Field 4C.
W87-08084

TURBIDITY CURRENTS AND SUBMARINE CHANNEL FORMATION IN RUPERT INLET, BRITISH COLUMBIA: 1. SURGE OBSERVATIONS,
Memorial Univ. of Newfoundland, St. John's. Dept. of Physics.
For primary bibliographic entry see Field 2J.
W87-08091

EFFECTS OF SAWDUST POLLUTION ON THE GERMINATION OF FUNGAL SPORES IN LAGOS LAGOON,
Lagos Univ. (Nigeria). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-08109

WATER PROPERTIES AND CIRCULATION IN SHELIKOF STRAIT, ALASKA DURING 1985,

National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. K. Reed, J. D. Schumacher, and L. S. Incze.
NOAA Technical Memorandum ERL PMEL-68, October 1986. 35 p, 30 fig, 6 tab, 13 ref.

Descriptors: *Shelikof Strait, *Alaska, *Water properties, *Water circulation, *Coastal waters, *Flow patterns, Seasonal variation, Estuaries.

Data from cruises in March, July, and October 1985 are used to describe circulation and property distributions, and their changes, in Shelikof Strait. The Alaska Coastl Current flows to the southwest throughout the year, but greatest baroclinic, geostrophic speeds occur in fall when the upper waters are least saline because of a maximum in freshwater discharge. The deep water in the central part of the Strait has its source to the south, and the properties seem to result from vertical mixing of this southern water. Thus Shelikof Strait has an estuarine-like circulation, but the intensity of the northward inflow varies appreciably. Property distributions showed isoclines were nearly always deepest on the right side of the channel (looking downstream); greatest baroclinic speeds were often there also. It is believed that differential Ekman pumping may be important to the development of this structure and its change, at least in some locations. Volume transport estimates for the upper 150 db varied greatly in space and time, with maximum values > 1,000,000 cu m/sec. At times the southwest flow bifurcated, with part continuing along the Alaska Peninsula and the rest exiting the main channel to the south. (Author's abstract)
W87-08200

COLUMBIA RIVER ESTUARY DATA DEVELOPMENT PROGRAM (CREDDP). DYNAMICS OF THE COLUMBIA RIVER ESTUARINE ECOSYSTEM. VOLUME 1,
Columbia River Estuary Study Taskforce, Astoria, OR.
C. Simenstad, D. Jay, C. D. McIntire, W. Nehlsen, and C. Sherwood.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-244474. Price codes: A16 in paper copy, A01 in microfiche. 340 p, 152 fig, 18 tab, 242 ref.

Descriptors: *Columbia River, *Estuaries, *Limnology, Data acquisition, Ecological effects, Biological properties, Physical properties, Ecosystems.

This report presents an ecological synthesis of the physical and biological studies carried out by the Columbia River Estuary Data Development Program (CREDDP). It is written primarily for estuarine scientists and resource managers with training in the physical and biological sciences. Comprehensive ecological studies of the Columbia River Estuary are given. Most studies have been site-specific and/or focused on target organisms. Although there is considerable data on physical and biological characteristics of the estuary, little information is available on relationships among biological processes and physical processes. This report, which focuses on physical-biological relationships and other ecological processes, provides a major advance in understanding of the Columbia River estuarine ecosystem. (Lantz-PTT)
W87-08206

PREDICTION OF SALINITIES IN THE MATAGORDA BAY AREA,
Texas Univ. at Austin. Center for Research in Water Resources.
J. A. Fitch, and N. E. Armstrong.
Technical Report No. CRWR 200, December 1982. 56 p, 7 fig, 11 tab, 25 ref.

Descriptors: *Matagorda Bay, *Texas, *Salinity, Bays, *Model studies, Calibrations, Sensitivity analysis, Mathematical models, Prediction.

The multi-compartment, completely mixed model used here, provides a reasonable representation of the behavior of the Matagorda Bay system of Texas. It accomodates the physical limitations of the system -- its shallow depths and the wind mixing -- in its assumptions of a group of completely mixed reactors. General salinity trends within the system are consistently obtained. Long-term salinity calibrations were achieved with greater precision than were short-term calibrations. In addition, use of a model calibrated with long-term data to predict a short-term sub-set of the data was more successful in the static case than in the dynamic case. This result was probably due to the greater response time allowed in the static model. Sensitivity analysis showed that the predicted sub-bay salinities were more sensitive to changes in freshwater inflows than to changes in exchange coefficients. Thus, the model is more sensitive to physical changes than it is to the calibration process. The dynamic case proved to be more sensitive to changes in exchange coefficients than did the static case. Although the model was not sufficient to predict exact changes resulting from alterations, the use of the model for the prediction of general trends was successful. (Lantz-PTT)
W87-08221

SPECIES DIVERSITY AND STRUCTURE OF MEIOBENTHIC COMMUNITIES IN A LAGOON ECOSYSTEMS (DIVERSITE SPECIFIQUE ET STRUCTURE DES PEUPLEMENTS MEIOBENTHIQUES D'UN ECOSYSTEME LAGUNAIRE),
Bordeaux-1 Univ., Talence (France). Inst. de Biologie Marine.
For primary bibliographic entry see Field 2H.
W87-08284

DISSEMINATION STRATEGIES OF TREMATODE CERCARIAE IN A MARINE LITTORAL ECOSYSTEM (STRATEGIES DE DISSEMINATION DES CERCAIRES DE TREMATODES DANS UN ECOSYSTEME MARIN LITTORAL),
Saint-Jerome Univ., Marseille (France). Lab. de Zoologie et Biologie Marines.
For primary bibliographic entry see Field 2H.
W87-08285

COASTAL UPWELLING ON A SLOPING BOTTOM: THE FORMATION OF PLUMES, JETS AND PINCHED-OFF CYCLONES,
University of Southern California, Los Angeles. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 8B.
W87-08316

COMPUTER BASED CULTURING SYSTEM FOR MEASURING THE PHOTOSYNTHETIC RESPONSE OF PHYTOPLANKTON TO A FLUCTUATING ENVIRONMENT,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
For primary bibliographic entry see Field 7B.
W87-08319

COMPARATIVE STUDY OF THE PATTERNS OF BIOACCUMULATION OF ESSENTIAL (CU, ZN) AND NON-ESSENTIAL (CD, PB) TRACE METALS IN VARIOUS ESTUARINE AND COASTAL ORGANISMS,
Nantes Univ. (France). Lab. de Toxicologie.
For primary bibliographic entry see Field 5B.
W87-08320

PATTERNS OF DISTRIBUTION OF DIATOM ASSEMBLAGES ALONG ENVIRONMENTAL GRADIENTS IN THE SEVERN RIVER ESTUARY, CHESAPEAKE BAY, MARYLAND,
Dickinson Coll., Carlisle, PA. Dept. of Geology and Environmental Sciences.
C. C. Wilderman.
Journal of Phycology JPYLAJ, Vol. 23, No. 1, p 209-217, March 1987. 6 fig, 4 tab, 33 ref.

Descriptors: *Population dynamics, *Diatoms, *Severn River Estuary, *Limnology, Salinity, Seasonal variation, Distribution, Chesapeake Bay, Estuaries, Taxonomy.

Distribution patterns of diatoms from natural substrates and surface waters of the Severn River, Maryland, are related to salinity and seasonal gradients through time and space by minimum spanning tree cluster analysis and principal components analysis. Assemblages were found to be distributed in a complex but orderly fashion, with primary discontinuities occurring between seasons, and between planktonic and attached forms. Within seasons, benthic groupings are distributed as continual along a horizontal salinity gradient, with one discontinuity at a location with a mean salinity of approximately .7%. Downstream from this discontinuity, most species do not follow the changing salinity patterns from season to season, and are considered euryhaline for a salinity range of .8 - 1.6%. Upstream from this discontinuity there is a relatively distinct and persistent assemblage of oligohaline indicators. Evidence derived by comparing this study with similar studies from Oregon estuaries indicates that similar distribution patterns, community structures and taxa can be expected to occur in estuaries on the east and west coasts of North America. (Author's abstract)
W87-08323

INFLUENCE OF MANGROVE-DERIVED TANNINS ON INTERTIDAL MEIOBENTHOS IN TROPICAL ESTUARIES,
Australian Inst. of Marine Sciences, Townsville.
D. M. Alongi.
Oecologia OECOBX, Vol. 71, No. 4, p 537-540, March 1987. 1 fig, 1 tab, 24 ref.

Descriptors: *Intertidal areas, *Limnology, *Tannins, *Mangroves, *Tropical estuaries, *Nematodes, Australia, Forests, Growth, Field tests, Leaves, Litter, Coastal waters.

Mangrove-derived tannins negatively effected laboratory-reared nematode populations and natural communities of meiobenthos in tropical mangrove forests along the northeastern coast of Australia. In the low and mid intertidal zones of five mangrove estuaries, nearly all of the dominant meiofaunal taxa correlated negatively with concentrations of sediment tannins. Only nematodes correlated with low tannin concentrations in the high intertidal zones. The negative exponential equation $y = be$ to the minus mx power represented the best-fit for most of the meiofauna-tannin relationships. The mangrove-dwelling nematode, Terschellingia longicaudata did not grow ($r = 0.001$) in the laboratory on fresh, tannin-rich leaves of the red mangrove, Rhizophora stylosa. Population growth of the nematode was significantly greater on fresh, tannin-poor leaves of the grey mangrove, Avicennia marina ($r = 0.081$) with best growth ($r = 0.112$) attained on a diet of tannin-free, mixed cereal. These preliminary field and laboratory results suggest that hydrolyzable tannins leached from mangrove roots and leaf litter are an important factor regulating intertidal meiobenthic communities in tropical mangrove forests along the northeastern Australian coast. (Author's abstract)
W87-08325

COBBIONEMA CAPENSE N. SP. FROM SWARTKOPS ESTUARY, PORT ELIZABETH (NEMATODA: SELACHINEMATIDAE),
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
J. P. Furstenberg, and J. Heyns.
Canadian Journal of Zoology CJZOAG, Vol. 65, No. 1, p 80-82, January 1987. 6 fig, 6 ref.

Descriptors: *Limnology, *Cobbionema, *Swartkops estuary, *Nematodes, *Estuaries, Fauna, South Africa.

Anew species of nematode is distinguished by the moderately cuticularized buccal cavity wall and teeth ridges. The salinity and water temperature ranges of the sampling site during 1979 were 15-26% and 16-26 C, respectivel Drawings depict some aspects of the new species. (Airone-PTT)
W87-08535

TREATMENT AND DISPOSAL OF WASTEWATERS FROM SETTLEMENTS AND TOURIST RESORTS IN THE MEDITERRANEAN COAST - STATE OF THE ART REVIEW,

Zagreb Univ. (Yugoslavia). Faculty of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-08541

TOWN OF VALLAURIS (FRENCH RIVIERA - AN EXAMPLE OF A COASTAL AREA SANITATION IMPROVEMENT PROJECT,
Lyonnaise des Eaux, Cannes (France).
For primary bibliographic entry see Field 5D.
W87-08542

VIRAL POLLUTION OF COASTAL WATERS RESULTING FROM THE DISPOSAL OF UNTREATED SEWAGE EFFLUENTS,
Institut Pasteur Hellenique, Athens (Greece). Dept. of Virology.
For primary bibliographic entry see Field 5B.
W87-08543

IMPACT OF 'ORGANIC 'POLLUTANTS ON COASTAL WATERS, GULF OF TRIESTE,
Trieste Univ. (Italy). Ist. di Idraulica.
For primary bibliographic entry see Field 5C.
W87-08545

WASTEWATER DISPOSAL IN THE RIJEKA REGION,
Institute for Physical Planning and the Protection of the Environment, Istarska (Yugoslavia).
For primary bibliographic entry see Field 5E.
W87-08547

OBJECTIVES AND ACHIEVEMENTS OF THE THREE CONFERENCES ON THE PROTECTION OF THE ADRIATIC SEA,
For primary bibliographic entry see Field 5G.
W87-08560

POLLUTION OF THE BEACHES OF ALEXANDRIA DUE TO THE DISCHARGE OF SEWAGE: A CASE STUDY,
Alexandria Univ. (Egypt). Dept. of Environmental Health.
For primary bibliographic entry see Field 5B.
W87-08565

PRELIMINARY RESULTS OF THE JOINT ITALIAN-YUGOSLAV RESEARCH PROGRAM ON THE POLLUTION OF THE ADRIATIC SEA,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5B.
W87-08567

EUTROPHICATION OF COASTAL WATERS - GULF OF TRIESTE,
Trieste Univ. (Italy). Ist. di Idraulica.
For primary bibliographic entry see Field 5B.
W87-08568

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

WATER: TOO MUCH, TOO LITTLE, TOO POLLUTED,
For primary bibliographic entry see Field 5G.
W87-07679

CROSSFLOW MEMBRANE FILTRATION EXPANDS ROLE IN WATER TREATMENT,
For primary bibliographic entry see Field 5F.
W87-07924

3B. Water Yield Improvement

WATER: TOO MUCH, TOO LITTLE, TOO POLLUTED,
For primary bibliographic entry see Field 5G.
W87-07679

DELAYED EFFECTS OF CLOUD SEEDING WITH SILVER IODIDE,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Atmospheric Research.
E. K. Bigg, and E. Turton.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 10, p 1382-1386, October 1986. 3 fig, 7 ref.

Descriptors: *Cloud seeding, *Silver iodide, *Tasmania, *Nucleation, *Bacteria, *Weather modification, *Chemistry of precipitation, Ice, Ice formation, Statistical analysis, Rainfall, Grasslands, Ecological effects.

Apparent delayed effects of aerial cloud seeding with silver iodide are demonstrated in Smith et al.'s experiment in Tasmania. These effects reached a maximum nine days after a seeded day and were most unlikely to have arisen by chance. A possible cause of these and even more delayed effects of seeding is shown to be the enhancement of concentrations of airborne ice-nucleating bacteria by small amounts of silver iodide applied to vegetation. This was demonstrated in direct tests utilizing two plots enclosed by transparent polyethylene sheets stretched on a wooden frame 2 m high. Ice nuclei were collected on membrane filters. Each chamber was provided with an overhead water system using three fine misting jets and was watered for 5 min every 6 h from the start of the experiment in January 1985 to about 100 days after the addition of silver iodide in March. The enhancement of ice nuclei reached a maximum between days 90 and 180. It is concluded that anyone contemplating a cloud seeding experiment should include an extended ice-nucleus measuring network in the essential physical observations accompanying the experiment and incorporate lengthy unseeded periods to check for persistent effects of seeding. (Author's abstract)
W87-07934

WEATHER MODIFICATION IN ARID REGIONS: THE ISRAELI EXPERIENCE,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
L. Berkofsky.
Climatic Change CLCHDX, Vol. 9, No. 1/2, p 103-112, August-October 1986. 3 fig, 1 tab, 14 ref.

Descriptors: *Model studies, *Weather modification, *Arid zone, *Israel, *Albedo, *Numerical analysis, *Cloud seeding, Climatic zones, Radiation, Mathematical studies, Mathematical models, Mathematical equations, Deserts, Rainfall, Artificial precipitation, Precipitation, Clouds, Cloud physics, Flooding, Silver iodide, Dynamics.

One of the suggestions for modifying weather in semi-arid zones is to alter the albedo over large geographical areas. Most effort along these lines has involved the use of numerical models in which it is possible to alter the albedo. Using Negev data, it is shown that the albedo would have to have changed over a minimum of 250 km in order to observe the effect of the change in the model. Experiments to enhance rainfall by cloud seeding in Israel have been carried out for 26 years, mostly in the northern part of the country. Two methods of seeding are discussed: 'static', in which seeding causes changes in the cloud's microphysics, and 'dynamic', in which seeding causes changes in the cloud's dynamics. Seeding probably alters both the dynamics and microphysics, so that a properly constructed cloud model should account for both. (Author's abstract)
W87-07997

WATER RELATIONS OF TWO CALIFORNIA CHAPARRAL SHRUBS,
California Univ., Davis. Dept. of Botany.
J. J. Hart, and S. R. Radosevich.
American Journal of Botany AJBOAA, Vol. 74, No. 3, p 371-384, March 1987. 9 fig, 3 tab, 35 ref.

Descriptors: *Evapotranspiration, *Plant water use, *Chaparral, *Drought effects, *Water potential, *Transpiration, Shrubs, Chamise, Manzanita, California, Leaves, Plants, Drought.

Water use patterns of two California chaparral shrub species, chamise (Adenostoma fasciculatum H. and A.) and Stanford manzanita (Arctostaphylos stanfordiana Parry), were compared during summer drought. Observations of diurnal and seasonal courses of shoot water potential, leaf conductance and transpiration revealed that chamise was more conservative in water use than manzanita. Evidence obtained cast doubt on a hypothesis previously proposed to explain an anomalous pattern of shoot water potential in chamise. (Author's abstract)
W87-08050

PROJECT SKYWATER 1985-86 CRADP DATA INVENTORY: COLORADO RIVER AUGMENTATION DEMONSTRATION PROJECT.
Water and Power Resources Service, Denver, CO. Office of Atmospheric Resources Management.
For primary bibliographic entry see Field 2B.
W87-08235

3C. Use Of Water Of Impaired Quality

CAN GRAIN ABSORB VOLATILE PHENOLS FROM IRRIGATING WATER: THIN-LAYER CHROMATOGRAPHY OF STEAM-VOLATILE PHENOLS IN THE WASTE WATER OF THE PETROLEUM INDUSTRY AND THE GRAIN IRRIGATED BY IT,
Agricultural Biology Research Inst., Beijing (China).
For primary bibliographic entry see Field 5A.
W87-07620

PRELIMINARY OBSERVATIONS ON USE OF ETHANOL DISTILLER'S BY-PRODUCTS FOR POLYCULTURE OF FRESHWATER PRAWN (MACROBRACHIUM ROSENBERGII) AND GOLDEN SHINER (NOTEMIGONUS CRYSOLEUCAS),
Southern Illinois Univ. at Carbondale. Fisheries Research Lab.
C. C. Kohler, W. M. Lewis, and S. P. Krueger.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84-014850. Price codes A02 in paper copy and A01 in microfiche. (1983). 21 p. 2 fig, 8 tab, 11 ref. DOE Contract DE-FG02-81510295.

Descriptors: *Impaired water use, *Shiner, *Diets, *Aquaculture, *Industrial wastes, *Polyculture, *Shrimp, *Water reuse, Fish, Water pollution effects, Biological oxygen demand, Ponds, Productivity, Water temperature.

Two major by-products of ethanol distillation, corn distiller's solubles and corn distiller's mash, were evaluated for their potential use as a food source for freshwater prawn (Macrobrachium rosenbergii) and golden shiner (Notemigonus crysoleucas) in mid-western United States. Corn distiller's solubles were not found to be highly toxic to aquatic organisms at concentrations ranging up to 10,000 ppm. However, the high biological oxygen demand of the material requires that single applications not exceed 2000 ppm. Yield trials were conducted over a four month period in five 0.1 ha earthen ponds, located in proximity to an ethanol distillery. Each pond was stocked with 2000 post-larval shrimp (0.02 g mean weight). Three of these ponds were also each stocked with 75 adult golden shiner (27.0 g mean weight). One application of corn disttiller's solubles (equivalent to about 2000 ppm) and three applications of corn distiller's mash (about 5 kg/application) were made over the course of the yield trials (about 120 days). No other food or fertilizer wsa added to the ponds.

Survival of shrimp ranged from 34 to 75%. Survival of brook fish exceeded 90%. Mean weight of shrimp at harvest was approximately 12 g, and average production was equivalent to approximately 104 kg/ha. Golden shiner reared in the same ponds as shrimp had production rates equivalent to approximately 130 kg/ha. The presence of fish did not appear to impede shrimp production. Although production results of fish and shrimp were encouraging, several factors existed which impeded productions; these included: (1) little by-product was applied to ponds becuase the distillery was undergoing its 'shakedown' period; (2) ponds were new and had minimal natural productivity; (3) grass was not fully established on the watershed and ponds became turbid; and (4) lower than normal temperatures prevailed over much of the growing period. Accordingly, it is anticipated that production of fish and shrimp can be significantly increased in future trials, and that aquaculture may be a profitable means for utilizing the by-products of corn-ethanol distillation. (Author's abstract)
W87-07661

IRRIGATION WITH RECLAIMED MUNICIPAL WASTEWATER-A GUIDANCE MANUAL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
Lewis Publishers, Chelsea, Michigan. 1985. Edited by G. Stuart Pettygrove and Takashi Asano. 435 p.

Descriptors: *Impaired water use, *Water reuse, *Wastewater irrigation, *Municipal wastewater, *Irrigation practices, *Reclaimed water, Design standards, Fate of pollutants, Water quality, Water management, Salinity.

This book is for use in the planning, design, and operation of agricultural and landscape irrigation systems using reclaimed municipal wastewater. It is written for civil and sanitary engineers, agricultural engineers, and agricultural extension workers and consultants. The manual is also useful as a reference for public works officials, municipal wastewater treatment plant operators, and students at colleges and universities. Several chapters were written specifically for California readers, but much is applicable to arid and semi-arid environments outside of California. The emphasis in this manual is on the beneficial use of reclaimed wastewater for agricultural and landscape irrigation. An example of the topics discussed are: crop water use, irrigation water quality, water management for sodicity and salinity control, irrigation systems design, and fate of wastewater constituents. (See also W87-07663 thru W87-07677) (Lantz-PTT)
W87-07662

INTRODUCTION: CALIFORNIA'S RECLAIMED MUNICIPAL WASTEWATER RESOURCE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
G. S. Pettygrove, D. C. Davenport, and T. Asano.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 1-1 to 1-14, 3 tab, 6 ref.

Descriptors: *Impaired water use, *Water reuse, *Irrigation practices, *California, *Municipal wastewater, Wastewater irrigation, Water use, Economic aspects, Legal aspects.

Much of California is semiarid. It not only has a poor geographic and seasonal distribution of water, but also faces increasing competitive demands for that water. Although the state's fresh water resources are abundant, not all of them are available to meet agricultural, municipal, industrial, environmental, and instream demands. Furthermore, much of the water demand occurs in areas where rainfall and local supplies are insufficient, thereby requiring importation of fresh water and wastewater reuse. Some of the water that is reused includes treated municipal wastewater which must be applied in accordance with increasingly stringent regulations. Efforts should be continued to gainfully use this resource by irrigating selected agricultural and landscape vegetation and by supplementing freshwater supplies through return flows to streams and groundwater. Current use of treated municipal wastewater, potential for additional irrigation with reclaimed municipal wastewater, and the health, environmental, legal, institutional and economic aspects of wastewater irrigation are discussed in this introduction. (See also W87-07662) (Lantz-PTT)
W87-07663

MUNICIPAL WASTEWATER: TREATMENT AND RECLAIMED WATER CHARACTERISTICS,
California State Water Resources Control Board, Sacramento. Office of Water Recycling.
For primary bibliographic entry see Field 5D.
W87-07664

IRRIGATION WATER QUALITY CRITERIA,
California Regional Water Quality Control Board, Sacramento. Central Valley Region.
For primary bibliographic entry see Field 5D.
W87-07665

SITE CHARACTERISTICS,
Nolte (George S.) and Associates, Sacramento, CA.
R. W. Crites.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 4-1 to 4-19, 2 fig, 3 tab, 7 ref.

Descriptors: *Impaired water use, *Water reuse, *Site selection, *Irrigation practices, *Wastewater irrigation, Irrigation effects, Soil properties, Reclaimed water, Municipal wastewater, Groundwater, Land use, Agriculture.

The characteristics of the site to be used for agricultural or landscape irrigation with reclaimed municipal wastewater can affect the planning, design, and management of the system. In this chapter, the important characteristics affecting site evaluation and field investigations for determining infiltration rate and soil permeability are described. The effects of vegetation, wastewater loadings, and management on infiltration rates are discussed. Important factors in site evaluation include topography, soils, geology, groundwater, land use, and climate. Other variables that affect system planning include wastewater characteristics, water quality criteria, agricultural practices in the area, the selected crop, and water rights. Agricultural practices can affect site selection if the area is dominated by vegetable cropping or other high-value specialty crops. (See also W87-07662) (Lantz-PTT)
W87-07666

CROP WATER USE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2D.
W87-07667

CROP SELECTION AND MANAGEMENT,
California Univ., Davis. Dept. of Agronomy and Range Science.
M. R. George, G. S. Pettygrove, and W. B. Davis.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 6-1 to 6-18, 2 tab, 12 ref.

Descriptors: *Impaired water use, *Water reuse, *Crop production, *Irrigation practices, *Wastewater irrigation, *California, Economic aspects, Crop yield, Water quality, Forages.

The choice of crop species to be irrigated will influence the type of water distribution system selected and the timing and depth of irrigation water applied. In choosing the crop, a farmer is influenced by economics, climate, soil and water characteristics, management skill, labor and equipment availability, and tradition. If reclaimed wastewater is substituted for a fresh water source, additional constraints are introduced. The degree to which the use of wastewater influences crop selection depends on the goals of the user and the treatment plant designers and on the wastewater properties. If the main objective is to produce a profitable crop on the maximum number of acres, and if the water quality is satisfactory according to agricultural criteria, then the use of wastewater will not greatly affect the choice of crop species. Where water quality is limiting or where other objectives intrude (such as wastewater disposal), the use of wastewater can greatly influence the selection of plant species. This chapter presents a summary of crop selection criteria, with emphasis on selection and management of perennial forage species. (See also W87-07662) (Lantz-PTT)
W87-07668

WATER MANAGEMENT FOR SALINITY AND SODICITY CONTROL,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5D.
W87-07669

IRRIGATION SYSTEM DESIGN,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3F.
W87-07670

ON-FARM ECONOMICS OF RECLAIMED WASTEWATER IRRIGATION,
California Univ., Davis. Dept. of Agricultural Economics.
C. V. Moore, K. D. Olson, and M. A. Marino.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 9-1 to 9-30, 3 fig, 7 tab, 11 ref.

Descriptors: *Impaired water use, *Water reuse, *Economic aspects, *Wastewater irrigation, *Reclaimed water, *Farms, Agriculture, Cost analysis, Water supply, Irrigation practices, Crop production, Salinity, Model studies.

For irrigation with reclaimed wastewater to be a reasonable alternative for municipalities, financial and economic feasibility for farm owners-operators, landowners, and farm tenants must be shown. Financial and economic feasibility are important to both the farmer and the municipality. In the case where a municipality owns the land, the project must be attractive to potential tenants: landowners/farm operators must be better off contracting for the water rather than doing without. This chapter focuses on the farmer's view. Briefly described are the supply charateristics of treated wastewater with respect to seasonality of flows (with and without storage), transportation costs, and pricing considerations. Components making up economic demand for treated wastewater, including monthly evapotranspiration of adoptable crops, alternative application methods, nutrient value of primary and secondary treated wastewater, and salinity problems, and risk and uncertainty, are characterized. The chapter concludes with a look at the treatment-disposal system as a whole using a linear programming model of an individual farm to indicate the sensitivity of a profit-maximizing farm operator to variations in the supply-and-demand characteristics and contractual arrangements of reclaimed wastewater. (See also W87-07662) (Lantz-PTT)
W87-07671

HEALTH AND REGULATORY CONSIDERATIONS,
California Dept. of Health Services, Berkeley. Sanitary Engineering Section.
J. Crook.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 10-1 to 10-49, 3 tab, 90 ref.

Descriptors: *Impaired water use, *California, *Wastewater irrigation, *Water reuse, Wastewater treatment, Municipal wastewater, Pathogens, Regulations.

The State of California has long recognized the value of reusing wastewater and for many years has encouraged such reuse where public health is not compromised. Advances in wastewater treatment technology, including treatment reliability, allow the safe use of effluents for several purposes when reasonable precautions are taken. The purpose of this chapter is: (1) to summarize the health aspects of irrigation with reclaimed municipal wastewater, especially as related to pathogens, and (2) to describe the regulations in California that govern the reuse of treated wastewater. (See also W87-07662) (Lantz-PTT)
W87-07672

LEGAL ASPECTS OF IRRIGATION WITH RECLAIMED WASTEWATER IN CALIFORNIA,
Hansen, Boyd, Culhane and Mounier, Sacramento, CA.
For primary bibliographic entry see Field 6E.
W87-07673

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: NITROGEN AND PHOSPHORUS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W87-07674

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: TRACE ELEMENTS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-07675

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: PATHOGENS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-07676

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: TRACE ORGANICS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-07677

CONSERVING WATER: THE UNTAPPED ALTERNATIVE,
Worldwatch Inst., Washington, DC.
S. Postel.
Worldwatch Paper 67, September 1985. Worldwatch Inst., Washington, DC. 66 p.

Descriptors: *Water conservation, *Irrigation efficiency, *Recycling, *Water reuse, *Wastewater renovation, Water supply development, Water management, Metropolitan water management, Sprinkler irrigation, Water use, Consumptive use, Nonconsumptive use, Water use efficiency, Water costs.

As water supplies around the world rapidly decrease, water shortages will limit agricultural output and economic growth. Many alternative investments in efficiency and improved management yield more usable water per dollar than do conventional water supply projects such as dams and river diversions. Worldwide, the efficiency of irrigation systems averages only 37%. The low-energy precision application (LEPA) method of irrigation can upgrade conventional sprinkler designs from 70% to 95% efficiency. In developing countries, better management could reduce water withdrawals for most canal systems by 10-15%, allowing new land to be brought under irrigation at a much lower cost than develping new water supplies. Farmers will not invest in water efficiency unless pricing policies that promote wastefulness are dismantled. When charged more for water, farmers use water more efficiently. Industries have made some impressive gains in water efficiency. Recycling rates in the major water-using manufacturing industries in the United States have steadily risen in recent decades, with the paper industry recycling its water 5.3 times, petroleum refineries about 7 times, and chemical product manufacturers about 3 times. As wastewater discharge standards get more stringent and treatment costs increase, recycling becomes more economically attractive. Economic incentives can also spur water efficiency in urban areas. Water conservation measures in domestic use have already been implemented in some states. The transition to a water-efficient economy could be made more quickly and uniformly if conservation standards were set at the federal level. (Geiger-PTT)
W87-07722

INTEGRATED MANAGEMENT SCHEME PRESERVES SCARCE WATER,
For primary bibliographic entry see Field 5D.
W87-07816

AMELIORATION OF A CALCAREOUS SOLONETZIC SOIL BY IRRIGATION, DEEP RIPPING, AND ACIDIFICATION WITH ELEMENTAL SULFUR,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 2G.
W87-07913

EFFECT OF SUBSOILING ON WHEAT YIELD AND SALT DISTRIBUTION OF A SOLONETZIC SOIL,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 2G.
W87-07915

OPTIMAL IRRIGATION MANAGEMENT UNDER POOR DRAINAGE AND SALINE CONDITIONS,
California Univ., Riverside.
J. Letey, A. Dinar, and K. C. Knapp.
California Agriculture CAGRA3, Vol. 40, No. 1/2, p 20-21, January-February 1986. 2 fig.

Descriptors: *Impaired water use, *Irrigation design, *Salinity, *Land management, *Drainage, *Water table rise, *Crop production, *Optimization, *Model studies, *Irrigation, Saline soils, Soil types, Irrigation programs, Irrigation efficiency, Irrigation practices, San Joaquin Valley, Agriculture, Chemical properties, Evapotranspiration, Salt tolerance, Drainage water, Cropland, Water management, Crop yield, Economic aspects.

Optimal water management on farmland suffering from saline conditions and high water tables is considerably different from management on land free of these problems. A crop production function model was used as the basis for economic evaluation of water management at the field level under various drainage situations typical of the west side of the San Joaquin Valley. The effects of increasing tolerance by breeding were found to be more significant for crops that are initially sensitive than for tolerant crops. It was also determined that using a combination of fresh and saline water was not feasible for more sensitive crops. Combining fresh and drainage waters becomes more feasible as the salinity of the drainage water decreased, crop tolerance to salinity increased, or the relative price of drainage to fresh water decreased. (Doria-PTT)
W87-08010

SEWAGE EFFLUENT - A WATER RESOURCE,
M. R. G. Taylor, and J. M. Denner.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 41, No. 1, p 40-50, February 1987. 6 tab, 23 ref.

Descriptors: *Impaired water use, *Water reuse, *Effluents, Water resources, Recycling, Irrigation, Potable water, Economic aspects, Water quality.

The importance of sewage effluent as a water resource in terms of contributions to irrigation, indirect reuse for potable supplies via rivers, and direct use in industry is discussed. Factors affecting its use, in particular the social, economic and quality requirements, are outlin..d and examples of successful reuse are described. (Author's abstract)
W87-08088

MERCURY CONTENT OF SHRIMP (PENAEUS VANNAMEI) REARED IN A WASTEWATER-SEAWATER AQUACULTURAL SYSTEM,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W87-08115

EVALUATION OF GROWTH AND PRODUCTION OF JARAQUIS (SEMAPROCHILODUS SPP) IN A TERRA FIRMA STREAM IMPOUNDMENT IN THE ENVIRONS OF MANAUS, AMAZONAS (AVALIACAO DO CRESCIMENTO E DA PRODUCAO DE JARAQUIS (SEMAPROCHILODUS SPP), EM DE IGARAPE DE TERRA FIRME NOS ARREDORES DE MANAUS, AMAZONAS),
Instituto Nacional de Pesquisas da Amazonia, Manaus (Brazil).
For primary bibliographic entry see Field 2H.
W87-08274

INVESTIGATION OF THE TREATMENT AND RECYCLING OF OIL REFINERY WASTEWATER,
Titograd Univ. (Yugoslavia). Inst. of Chemistry.
For primary bibliographic entry see Field 5D.
W87-08550

STATE OF THE ART REVIEW: AN EPIDEMIOLOGICAL APPROACH TO THE HEALTH EFFECTS OF WASTEWATER REUSE,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
For primary bibliographic entry see Field 5C.
W87-08554

REUSE OF WASTEWATERS IN AGRICULTURE BY MEANS OF SPRINKLER IRRIGATION ON A FARMLAND AREA OF 3000 HA - LARGE SCALE EXPERIENCE IN GERMANY,
Technische Univ., Brunswick (Germany, F.R.). Inst. fuer Standbauwesen.
R. Boll, and R. Kayser.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 163-173, 1986. 2 fig, 7 tab, 5 ref.

Descriptors: *Wastewater treatment, *Wastewater renovation, *Water reuse, *Wastewater irrigation, *Sprinkler irrigation, *Impaired water use, Irrigation, Agriculture, Germany, Wastewater farming, Activated sludge process, Surface irrigation, Wastewater management, Economic aspects.

The Braunschweig wastewater land treatment system, the largest in West Germany, serves a population of about 270,000 and has an annual flow of approximately 22,000,000 cu m. The whole treatment process consists of three main components: a pre-treatment plant as an activated sludge process, a sprinkler irrigation area of 3,000 ha of farmland and an old sewage farm of 200 ha with surface flooding. Experiences with management and operation of the system, treatment results with reference to environmental impact, development of agriculture, and some financial aspects are summarized. (Author's abstract)
W87-08555

USE OF WATER IN ADRIATIC COASTAL TOURIST SITES,
Zagreb Univ. (Yugoslavia). Faculty of Civil Engineering.
S. Tedeschi.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 175-183, 1986. 4 fig, 2 tab, 8 ref.

Descriptors: *Impaired water use, *Water conservation, *Domestic water, *Agricultural water, *Water quality, Impaired water quality, Coastal waters, Tourism, Yugoslavia, Water use, Adriatic Sea, Reclaimed water, Wastewater.

Fresh water is in short supply in the Yugoslav coastal area and especially so on the islands. The use of fresh water for regional water supply systems is comparatively expensive and it is used for purposes which do not demand high quality water. An analysis of the water consumption in tourist areas suggests that the peak consumption could be lowered by 23 to 37.5 percent, thus saving about 32.2 percent of the total annual water mass. This equals about 70 percent of the total one-day flow of the Yugoslav rivers into the Adriatic. Recycled water can be used for agricultural purposes and for aquaculture, which makes it possible to use the nutrients from wastewater and to lower the quantity of waste matter in the coastal sea. (Author's abstract)
W87-08556

PROBLEMS ASSOCIATED WITH PARTICULATE MATTER IN WATER REUSE FOR AGRICULTURAL IRRIGATION AND THEIR PREVENTION,
Hebrew Univ., Jerusalem (Israel). School of Applied Science and Technology.
For primary bibliographic entry see Field 5D.
W87-08557

FROM COASTAL WATER POLLUTION CONTROL TO THE RECLAMATION OF SEWAGE,
For primary bibliographic entry see Field 5E.
W87-08566

WASTEWATER CRITERIA FOR IRRIGATION IN ARID REGIONS,
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Dept. of Civil Engineering.
I. Ali.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 173-183, May 1987. 8 tab, 24 ref. UPM Research CE/WATER/17.

Descriptors: *Water reuse, *Impaired water use, *Irrigation, *Arid lands, *Wastewater farming, *Treated water, *Agriculture, Wastewater, Effluents, Alfalfa, Squash, Onions, Saudi Arabia.

With rapid growth of agriculture coupled with increasing population and urbanization, the demand for water in the Kingdom of Saudi Arabia is continually on the increase, causing, alarming drawdown in the deep aquifers, the traditional source of water. Sewage could be a valuable source to augment this dwindling water supply, at least the irrigation supplies, and should not continue to be wasted. However, between the two extremes of use of untreated sewage for irrigation as practiced in some countries and very stringent standards that necessitate an expensive tertiary treatment, there exists a middle-of-the-road approach. This moderate alternative combines flexibility with a permit system on a case-by case basis to make the best use of this valuable commodity. This viewpoint is strengthened by the experimental results obtained on a 50-m x 25-m (160-ft x 80-ft) University of Petroleum and Minerals (UPM) farm, where secondary treated effluent with chlorination was used through a sprinkler system to grow alfalfa, summer squash, and onions based on the bacteriological analysis of the crops. Possible guidelines for establishing water criteria for the wastewater reuse for irrigation in the kingdom are suggested in light of the experiments and taking into account the practices in various countries. (Author's abstract)
W87-08582

3D. Conservation In Domestic and Municipal Use

SAVING WATER IN A DESERT CITY,
Arizona Univ., Tucson.
W. E. Martin, H. M. Ingram, N. K. Laney, and A. H. Griffin.
Resources for the Future, Washington, DC. 1984. 111 p.

Descriptors: *Water demand, *Water conservation, *Water shortage, *Water costs, *Deserts, *Municipal use, Arid lands, Water policy, Political aspects, Pricing, Water scarcity, Water requirements, Policy making, Consumptive use, Nonconsumptive use, Water law, Economic aspects.

This book, which sets out to analyze a political battle over water pricing by a desert area municipal system, provides improved methods for demand function estimation where block rates are involved, suggest procedures for rational pricing of municipal water, and attempts to explain how politics can dominate the decision making process. Chapter 1 examines the problems connected with water scarcity, and outlines the objectives of policy analysis and the Tucson case study. Chapter 2 describes water policy, use and supply in the Tucson area and provides the basis for the discussion of water conservation in Chapter 3. Chapters 4 and 5 contain an analysis of water pricing and the significance of price in Tucsonans' conservation behavior. Chapter 6 focuses on the politics of water conservation, including the political benefits and costs to politicians of pursuing a conservation strategy as well as the impact of politics on water users' practices. Chapter 7 examines the practices available to the individual water user toward whom conservation strategies are directed. The final chapter sums up the issues discussed, particularly the questions of whether and to what extent it is possible to change water management practices so that they correspond better to physical and economic realities. (Geiger-PTT)
W87-07697

CONSERVING WATER: THE UNTAPPED ALTERNATIVE,
Worldwatch Inst., Washington, DC.
For primary bibliographic entry see Field 3C.
W87-07722

POINDEXTER V. NICHOLS HILLS,
For primary bibliographic entry see Field 6E.
W87-07794

PROCEEDINGS OF THE NATIONAL WATER CONSERVATION CONFERENCE ON PUBLICLY SUPPLIED POTABLE WATER.
Dynamac Corp., Rockville, MD.
For primary bibliographic entry see Field 5F.
W87-08420

WATER LAW: IMPACT ON CONSERVATION,
Virginia Water Resources Research Center, Blacksburg.
For primary bibliographic entry see Field 6E.
W87-08421

MOTIVATING THE PUBLIC TO SAVE WATER IN THE ABSENCE OF A CRISIS,
North Marin County Water District, Novato, CA.
J. O. Nelson.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 27-36, 2 fig, 1 tab.

Descriptors: *Water conservation, *Public participation, *Municipal water, *Water shortage, Water supply, Water demand.

Managing municipal water demands on a regular basis can be an important tool in helping to balance the supply-demand equation. Various elements or techniques can be considered by the utility, i.e., consumer education, pricing formulas, devices suitable for retrofitting existing homes, devices suitable for new development, irrigation equipment, drought-tolerant plant materials, and codes and regulations. The question becomes one of how one c implement these elements and induce consumers to save water when there is no spectre of a water shortage to help congeal public action. In this paper, the author shares his experiences in implementing water conservation in the North Marin County Water District and provides some tips and advice that have evolved from this experience. The thrust is a 'volunteerism' type approach that first seeks a commitment from the consumer, followed by education and supply of materials, and lastly, follow-through surveys to determine the effective penetration of the idea or technique. Much of the advice developed by the author parallels empirically derived criteria employed by successful advertising agencies. (See also W87-08420) (Author's abstract)
W87-08422

WATER-SAVING PLUMBING: A FLOW CONTROL AND MAINTENANCE PROGRAM TO REDUCE AND CONTROL WATER USE IN MULTI-HOUSING PROPERTIES,
Metropolitan Watersaving Co., Washington, DC.
D. P. Wilborn.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 47-51.

Descriptors: *Water conservation, *Flow control, *Maintenance, *Domestic water, Economic aspects, Installation, Water use.

Management responsible for budgeting operating expenses at apartment and condominium communities has expressed increasing interest in devices to save water and energy as utility costs have increased rapidly in recent years. In far too many cases, however, management failed to put forth an effort toward reducing water consumption equal to their interest. Unfortunately, many efforts directed toward saving water produced results far inferior to what can be expected from a water conservation program. Being absolutely certain that flow control devices can provide a significant reduction in consumption, decisions have been made to market devices through a program of water management, thus guaranteeing results over which there was previously little or no control. Instead of delivering products to be used or abused at the whim of maintenance personnel, results would be delivered through a professional program of water management. A complete retrofit service is offered to modify existing showers, faucets and toilets to perform at more efficient flow rates. In addition to the hardware phase, other phases of the program include: (a) analysis of water use; (b) survey of building/unit fixture; (c) installation service to assure standardized flow rate on a per unit basis; and (d) monitoring service as follow-up. (See also W87-08420) (Lantz-PTT)
W87-08424

LANDSCAPING ALTERNATIVES AND IRRIGATION CONSERVATION,
Sanford Homes, Inc., Englewood, CO.
For primary bibliographic entry see Field 3F.
W87-08425

WATER CONSERVATION: THE LEAKS IN IMPLEMENTATION,
Environmental Policy Inst., Washington, DC.
For primary bibliographic entry see Field 3F.
W87-08426

DEVELOPING AND TESTING A WATER CONSERVATION HANDBOOK,
Environmental Protection Agency, Washington, DC.
B. Yeaman, and E. F. Wesely.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 69-80.

Descriptors: *Water conservation, *Domestic water, *Potomac River, *Frederick, *Maryland, Water use, Water policy, Public opinion.

The selling of water conservation has become a major public policy issue. The advertising community would suggest that a good start would be by educat the residential consumer. 'Easy Ways to Save Water, Money, and Energy at Hom a 23-page booklet produced by the Potomac River and Trails

Council, was designed to do this. This paper is the distillation of experience gained by the Environmental Protection Agency (EPA), which commissioned the booklet, and the Potomac River and Trails Council (PRTC), which designed and printed it. Also described is 'Project Water Watch', a program undertaken by PRTC in Frederick, Maryland, a small but developing city of 30,000 where there is no perceived water supply problem. With a small EPA grant, PRTC has been testing the attitudes of local residents about water conservation, and about the booklet 'Easy Ways to Save Water, Money, and Energy at Home'. (See also W87-08420) (Author's abstract)
W87-08427

STATE WATER CONSERVATION PLANNING GUIDE,
Water Resources Council, Washington, DC. State Programs Div.
For primary bibliographic entry see Field 6B.
W87-08429

ROLE OF LAND USE PLANNING IN WATER CONSERVATION,
American Planning Association, Chicago, IL.
W. Sanders, and C. Thurow.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 103-111, 3 fig.

Descriptors: *Water conservation, *Land use, Management planning, Water demand, Zoning, Domestic water, Public policy.

Land use planning and the regulatory controls that grow out of this process influence demand for water. Land development policies are formulated in the planning process and implemented through land use regulations. These regulations, especially zoning and subdivision controls, influence how much water a municipality will need by regulating the types of buildings that are built, their location, and the way open space is used around them. This paper examines how this influence can be used to conserve water. Water conservation elements in comprehensive plans are considered along with patterns of development that conserve water. Land use regulations that can serve to implement water conserving residential development are also examined. Land use planning can be important to water conservation. It can help conserve supplies or reduce demand. Traditionally, land use planners have not played a direct role in water supply planning, but for some time they have helped communities manage and protect watersheds or aquifer recharge zones that are threatened by urban growth. In recent years, a growing number of local planning to agencies have recognized the potential for land use planning to reduce the need for urban water. Some communities are now including water conservation elements in their comprehensive plans, which identify both opportunities for water conservation and implementing strategies. A few communities have also built water conserving principles into their zoning and subdivision regulations. (See also W87-08420) (Author's abstract)
W87-08430

AURORA, COLORADO: RATIONAL LANDSCAPE ALTERNATIVES,
Aurora Water Conservation, CO.
J. Rondon.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 113-119.

Descriptors: *Water conservation, *Aurora, *Colorado, *Landscaping, Water supply, Irrigation, Grading, Soil Grasses, Vegetation.

The City of Aurora, Colorado, lies starkly on the high plains at an elevation of 5,400 ft, with an annual precipitation of about 15 inches. Aurora, the fastest growing city over 100,000 population, has plowed and bulldozed of the native short grasses that use little water only to replace than by highly irrigated Kentucky Bluegrass lawns. The clayey and sandy soils characteristic to Aurora, lacking organic matter found in areas of greater rainfall, are susceptible to wind and soil erosion; and are forced to grow plants by the constant addition of water. Water comes to Aurora by transmountain diversions from distant areas in the Rocky Mountains west of Denver. Aurora competes with Denver for water rights. Water rights in Colorado are based on the appropriation doctrine, and water close to Aurora and Denver is fully appropriated. In 1979, Aurora put into action a water conservation program which has the potential to really conserve water. The goal is to reach every person with the best contemporary knowledge of environmental design, grasses, plants, soil, and watering techniques, in order to achieve a beneficial reduction in water use or in water losses. One of the major steps has been the compilation of local information about landscaping into a book. Written for the homeowner, the book has received metropolitan-wide support and acceptance. The design chapter is particularly exciting for the designer, as well as being very practical for the homeowner. It encourages the homeowner to design landscapes with a master planning approach. Landscape components are defined listing concepts, uses, advantages, and disadvantages. The eight components are plant materials, structures, mulches, irrigation, grading/contouring, soil, lighting and water (as a design feature). Other chapters discuss: grasses, plants (native and adapted), soil and watering. The City of Aurora has also formed a Water Conservation Office, and passed a lawn ordinance. (See also W87-08420) (Lantz-PTT)
W87-08431

WATER CONSERVATION AND WASTEWATER FLOW REDUCTION - IS IT WORTH IT,
California State Dept. of Water Resources, Sacramento.
J. S. Koyasako.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 123-133, 7 fig.

Descriptors: *Water conservation, *Wastewater management, *California, *Flow control, Case studies, Wastewater quality, Biological oxygen demand, Economic aspects.

Wastewater flow reduction was the subject of a recent research study largely funded by the Environmental Protection Agency (EPA). Two study reports were prepared: a detailed report published by EPA and a summary report published by the California Department of Water Resources. This study of indoor water conservation and resulting wastewater flow reduction arrived at one main conclusion: There are overwhelming benefits to be derived from community water conservation programs and they should be vigorously promoted. The effects on wastewater facilities are: (1) some agencies experienced two years of flow reduction, in 1976 and 1977, while others experienced only one year, in 1977. In the first year of reduction, the average flow reduction was 17%; 39% in the second year; (2) one-half of the 17 wastewater systems surveyed encountered operational problems during periods of flow reductions. In general, however, the problems were not severe enough to greatly affect the system operations; (3) remedial measures were taken to resolve the problems, and there were no documented cases where the wastewater facilities could not continue to be properly maintained; (4) changes in wastewater quality during periods of flow reduction did not generally result in more frequent treatment plant violations of BOD or suspended solids (SS) discharge requirements; (5) the BOD and SS concentrations of the wastewater entering the treatment plant generally increased while the concentrations leaving the plant generally decreased during years of flow reduction; (6) energy and chemical uses were the primary items affected by wastewater flow reduction; (7) The overall O and M costs for the wastewater collection system decreased slightly, with a maximum of 3% cost reduction at 50% flow reduction; (8) The decrease in energy use for the treatment plants amounted to a maximum of 20% at 50% reduction in flow due to lower pumping requirements for the hydraulic load. Use of chemicals ranged from a decrease of 30% to an increase of 50%. Water conservation benefits and costs for two case studies, effects of changes in wastewater effluent quality, and savings in future capital expenditures for secondary treatment plants are also presented. (See also W87-08420) (Lantz-PTT)
W87-08432

EFFECTS OF WATER CONSERVATION ON MUNICIPAL WASTEWATER TREATMENT FACILITIES,
Jefferson Associates, Inc., San Francisco, CA.
J. A. Davis, and T. A. Bursztynsky.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 135-143, 2 fig, 2 tab, 2 ref.

Descriptors: *Water conservation, *Wastewater treatment, *Municipal wastewater, *San Francisco, *California, Water treatment facilities, Municipal water, Hydraulic machinery.

As part of a regional environmental planning study, the Association of Bay Area Governments estimated the effects of water conservation on wastewater treatment facilities. In general, passive water conservation programs that save 10 - 20% of municipal water use will have a minor effect on existing secondary wastewater treatment plant performance. New facilities downsized to accomodate a 10 - 20% average dry-weather flow reduction would net a construction cost saving of 2 - 5%. Hydraulically sized unit processes could be downsized; organically loaded processes could not and may even need to be enlarged. (See also W87-08420) (Author's abstract)
W87-08433

PLANNING FOR THE FUTURE,
Seattle Dept. of Water, WA.
For primary bibliographic entry see Field 6B.
W87-08434

WATER CONSERVATION IN ARIZONA: PAST, PRESENT, AND FUTURE,
Arizona State Dept. of Health Services, Phoenix. Bureau of Water Quality Control.
D. M. Gillum.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 151-154, 2 ref.

Descriptors: *Water conservation, *Arizona, *Water law, Water quality, Water supply, Flow control, Groundwater supply, Deserts.

In the desert regions of Arizona and much of the Southwest, water is an extremely valuable commodity and should have the highest of priorities. Water conservation and good quality water are the key to our future and the future of the Nation. Arizona is currently involved in three water conservation programs. They are: (1) Beat the Peak and Slow the Flow, (2) flow reduction, and (3) a new groundwater law. Arizona has made substantial progress in water conservation. These three programs are discussed here, and are essential to the future of Arizona, for without an adequate water supply, desert living would be an impossibility. Conservation is the key to the future growth and general well-being of the State, and it will require a concerted effort on the part of all concerned. (See also W87-08420) (Lantz-PTT)
W87-08435

WATER CONSERVATION AS A LONG-RANGE SUPPLY OPTION FOR MASSACHUSETTS: DISPELLING THE MYTHS AND FACING REALITY,

Wallace, Floyd, Ellenzweig, Moore, Inc., Cambridge, MA.
H. S. Linsky.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 155-166, 27 ref.

Descriptors: *Water conservation, *Massachusetts, *Water supply, *Long-term planning, *Boston, Water storage, Water resources development, Water demand, Economic aspects.

The Metropolitan District Commission (MDC), serving Metropolitan Boston, is considering conservation as a long-term water supply option. The present MDC supply system has enormous storage capacity, however, and the impression of abundant water supply creates a situation quite different from the public perception of imminent shortages which characterize the national experience with water conservation. A conceptual framework must be developed for converting national experience to realistic expectations for a long-range program in an area suffering from a myth of abundance but facing a gradual depletion of supply. In order to include water conservation in long-range water supply plans expectations must be scaled down for potential demand reduction, and be more realistic when assessing the costs and benefits of various programs. (See also W87-08420) (Author's abstract)
W87-08436

WATER CONSERVATION IN RENTAL APARTMENT COMPLEXES BY MEANS OF CONTROLLED INSTALLATION OF WATER-SAVING DEVICES,
Maryland Dept. of Public Works, Ellicott City.
A. Frank.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 169-172.

Descriptors: *Water conservation, *Domestic water, *Installation, *Howard County, *Maryland, Flow regulators, Leakage, Cost analysis.

Howard County, Maryland, in common with many other local jurisdictions, is experiencing rapid growth of its population and housing stock. As a result, it is expected that demand for water and sewer service will continue to increase, and that expansion of service into new areas will be necessary. In order to satisfy these needs, major new investment will be required. A primary strategy designed to offset the impact of this trend is reduction of per capita water use and waste flow. The program which has been developed to implement the strategy will initially focus the County's efforts (to reduce water use and waste flow) on rental apartment complexes. It will be accomplished by employing a relatively unique concept: co-funded, controlled installation of watersaving devices concurrent with leak detection, repair, and preventive maintenance. Howard County proposes that the development of a practical conservation program, based on controlled use of resources and corrective maintenance, will result in significant reductions of water (and energy) costs relative to investment, will enhance the state-of-the-art, and will provide a valuable case study for use by other jurisdictions. (See also W87-08420) (Author's abstract)
W87-08437

ENHANCED WATER EDUCATION VERSUS STATUS QUO ET AL.,
Water and Man, Inc., Salt Lake City, UT.
For primary bibliographic entry see Field 6B.
W87-08438

INFORMATION AND CONSUMER ADOPTION OF WATER CONSERVATION MEASURES,
Southern Illinois Univ. at Carbondale. Dept. of Geography.
D. D. Baumann.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 179-190, 34 ref.

Descriptors: *Water conservation, *Education, *Information exchange, Public participation, Water supply, Water demand, Water use.

Educational campaigns concerning a specific issue are likely to fail unless they are based upon specific information about the recipients. There is some experience that some consumers respond to pleas for reducing water use during periods of shortage. However, during non-drought periods, more specific information is needed in order to design an effective water conservation program: it simply is not sufficient to assume that knowledge of water conservation measures will result in adoption. The fact that a person is aware of the opportunities to conserve water is no guarantee that he or she will act upon that information, except under conditions of a serious drought. Little is known about the effectiveness of water conservation measures, and even less is known about the changes required to elicit the public to adopt water conservation measures during times when drought is not present. The purpose of this paper is to briefly review what is known about the effects of public education programs on water conservation, conservation being the beneficial reduction in water use and/or water losses. The potential dividends to a better understanding of the public response to water conservation educational efforts are twofold: (1) to better predict the extent of public acceptance of conservation measures in order to obtain more precise estimates of effectiveness in water supply planning; and (2) to promote efficiency in water use. (See also W87-08420) (Lantz-PTT)
W87-08439

RESIDENTIAL WATER CONSERVATION HANDBOOK.
Pabon, Sims, Smith and Associates, Washington, DC.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 193-196.

Descriptors: *Water conservation, *Handbooks, *Domestic water, Flow regulators, Plumbing, Information exchange.

This practical guide to residential water conservation entails the review and evaluation of water-saving plumbing devices, appliances and techniques for their technical and economic feasibility, as well as their public acceptance and regional applicability. The resulting consumer handbook aimed at the homeowner was produced to help consumers conserve water. The handbook is organized into eight sections: (1) Why Conserve; (2) Down the Pipe, Down the Drain; (3) The Inside Story on Saving Water; (4) There's an Outside Chance You're Wasting Water; (5) The Cost of Water; (6) Spreading the Word on Water; (7) And What's More; and (8) Waterlog, A Trouble Shooting Guide. The handbook was market tested for content, theme, readability, language and style. A national information dissemination plan was researched to ensure widespread distribution of the handbook to targeted audiences. (See also W87-08420) (Lantz-PTT)
W87-08440

PROCEDURES MANUAL FOR EVALUATING WATER CONSERVATION PLANNING,
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 6B.
W87-08441

AWWA WATER CONSERVATION HANDBOOK,
American Water Works Association, Denver, CO.
G. L. Craft.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 207-209.

Descriptors: *Education, *Handbooks, *Water conservation, Metering, Water use, Public opinion.

The need for the American Water Works Association (AWWA) to publish its own water conservation handbook was brought to the forefront with the western drought years of 1975-76. An Ad Hoc Committee was formed by the AWWA Technical and Professional Council consisting of nine AWWA members from the water industry. The committee members were from all regions of the United States and were the most capable men available to oversee the formulation of the 'Handbook'. The 'Handbook' that was originally begun in 1977 is now nearing completion; it will be targeted to water utilities and will emphasize that water conservation is not a substitute for good management and planning. The 'Handbook' will also tell the water utilities that water conservation is not a substitute for eliminating system leakage. Also discussed in the 'Handbook' are: metering, water accountability, emergency measures, and public education. (See also W87-08420) (Lantz-PTT)
W87-08442

BEFORE THE WELL RUNS DRY: A HANDBOOK FOR DESIGNING A LOCAL WATER CONSERVATION PLAN.
New England River Basins Commission, Boston, MA.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 211-223.

Descriptors: *Water conservation, *Handbooks, *Management planning, Case studies, Public policy, Water supply, Water management.

In February 1979, the New England River Basins Commission (NERBC) received funds from the U.S. Geological Survey (USGS), Resources and Land Investigation Program, to research and develop a planning procedure for water conservation. The project included an extensive literature search, development of local case studies, interviews with water supply engineers and policy makers, and an evaluation of the effectiveness of alternative water conservation measures. From the information it gathered and analyzed, NERBC developed a seven-step procedure for designing a local conservation plan. The sources for the procedure and the procedure itself are presented in a two-volume technical report. In 1980, NERBC received additional funds from USGS's Water Resources Division to prepare a handbook for the practical application of the information contained in the technical report. The handbook is designed to provide a concise, clear-cut procedure for local water supply planners to follow in designing a conservation plan. The procedure outlined in the handbook has been reviewed by water supply engineers, administrators, superintendents, and planners throughout New England. It is flexible, can be used by any type of water utility, and can meet a variety of goals. This paper summarizes the information presented in the handbook. (See also W87-08420) (Author's abstract)
W87-08443

COST-EFFECTIVE RESIDENTIAL WATER CONSERVATION DECISIONS,
National Bureau of Standards, Washington, DC. National Engineering Lab.
S. F. Weber, B. C. Lippiatt, and A. P. Hillstrom.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 227-238, 4 tab, 3 ref.

Descriptors: *Water conservation, *Domestic water, *Cost-benefit analysis, Flow regulators, Water use, Costs, Cost analysis.

An economic decision rule is presented for utilities to use in recommending water-saving devices that are cost effective for homeowners. The role takes into account the major costs (acquisition, installation, operation, maintenance, repair, and replacement) and benefits (dollar savings on water, sewer, and energy bills) associated with the installation of water-saving devices. One of these benefits, the dollar value of water savings, depends critically on water prices. An analysis of the water rate schedules of a national sample of 90 utilities indicates that, because of the widespread use of large fixed and minimum charges, homeowners' actual benefits from saving a unit of water are significantly lower than the average price paid for water. Thus, estimated water bill reductions will frequently be overstated if calculated on the basis of average price. The decision rule allows one to select the economically optimal device from a set of mutually exclusive alternatives, or the economically optimal combination of compatible devices for all the plumbing services in the house. The paper concludes by describing an interactive computer program that performs all the calculations needed to implement the decision rule. (See also W87-08420) (Author's abstract)
W87-08444

WATER SUPPLY SIMULATION MODEL: ANALYZING FOR THE IMPLICATIONS OF CONSERVATION,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, R. M. Males, and W. E. Gates.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 239-245, 8 ref.

Descriptors: *Water conservation, *Water supply, *Simulation analysis, *Model studies, Water demand, Economic aspects, Drinking water.

Water conservation, as it relates to the operations of water supply systems, is not simply a problem of reducing user demand. Financing structures for water utilities are traditionally such that a reduction in demand may necessitate an increase in rates charged to the consumer, to avoid shortfalls in utility income for debt service and fixed operating expenses. In addition, a number of 'beneficiaries' of the water supply system, such as those who enjoy fire protection, or those whose land is more attractive for development due to the availability of water, but who are not major consumptive users of water, tend not to bear the potential increased unit costs associated with user demand reduction. The problem can be considered as one of spatial economics - water system customers of certain classes, located in portions of the service area, subsidize other beneficiaries of the system in other classes and areas. The impact of demand reduction, coupled with the existing financial and revenue structure, can be expected to exacerbate the existing subsidizations of water system beneficiaries. The Drinking Water Research Division of USEPA has developed a systematic approach, organized as a set of computer programs, to assist analysts in examining problems of spatial economics and physical behavior of water distribution systems. The approach, known as the Water Supply Simulation Model (WSSM), consists of a data base describing the physical, economic, and spatial characteristics of the distribution system and program modules to: create and maintain the data base; display it graphically; perform hydraulic network, time of travel, and other physical analyses; and to perform economic allocations to develop spatial cost of service. The system is general-purpose in nature, and can easily be modified to suit the needs of a specific situation. Through combination of concepts of spatial analysis, spatial economics, data base management, and analytical mathematical modeling, the WSSM provides a powerful tool for examining the consequence of alternative policies related to water supply utilities. The structure of the WSSM, and sample applications, are described. (See also W87-08420) (Author's abstract)
W87-08445

COST-EFFECTIVENESS OF POTABLE WATER CONSERVATION - MULTIFACETED APPROACH,
Battelle Pacific Northwest Labs., Richland, WA.
W. J. Hopp, and W. P. Darby.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 247-258, 2 tab, 10 ref.

Descriptors: *Water conservation, *Potable water, *Cost-benefit analysis, Domestic water, Cost analysis, Maintenance, Flow regulators, Plumbing.

Evaluated is the cost-effectiveness of household water conservation measures in terms of overall economic efficiency as well as from the individual points of view of homeowners, representatives of municipal wastewater treatment utilities, and representatives of pubic water supply utilities. The analysis considers potential capital and operation and maintenance cost savings resulting from reduced volumes of drinking water subject to conventional, as well as conventional and granular activated carbon, treatment processes; reduced volumes of domestic wastewater subject to secondary treatment; and reduced domestic hot water use. Evaluation is carried out using a net present equivalent which considers the time value of money as well as the effects of inflation and real price escalation. Results indicate that a household water conservation program consisting of a toilet-tank dam insert and a simple shower flow restrictor is cost-effective from all points of view considered. (See also W87-08420) (Author's abstract)
W87-08446

MUNICIPAL WATER CONSERVATION -- A WATER PROJECT THAT PAYS FOR ITSELF,
INTASA, Inc., Menlo Park, CA.
W. B. Betchart.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 259-266, 2 fig, 3 tab, 3 ref. OWRT Contract 14-34-0001-0485 and EPA Contract 68-01-5033 and 68-01-6052.

Descriptors: *Water conservation, *Municipal water, *Economic aspects, Cost-benefit analysis, Public participation, Long-term planning.

Municipal water conservation's direct economic impact is one of its most intriguing aspects. When analyzed and presented carefully, it is also one of water conservation's strongest selling points. This paper describes a structure utilized for analyzing municipal water conservation benefits and costs. The key to the structure is inclusion of all significant direct benefits and costs. Three examples of results from utilizing the analytical structure are then described. The most obvious question regarding municipal water conservation economics is one which was quickly asked at this conference -- 'If municipal water conservation is so economically sensible, why isn't it done more often'. This writer believes there will be more municipal water conservation, but that its present status and slow progress is related to three major needs at the community level: (1) Improved awareness of community-wide economics. Too often only part of the benefits are recognized. The water supply utility manager tends to look only at the cost savings for this utility and to ignore wastewater and hot water energy savings. Similarly, the wastewater and energy people consider only their areas of activity. The benefits of municipal water conservation are significant in all three areas and analyses must draw them together to create the needed community-wide picture; (2) Cooperative, community-wide, long-term outlook. Part of the answer is for the three utilities (water supply, wastewater, and energy) to work jointly in developing perspectives on the future needs of the community and beneficial ways of influencing those needs; and (3) Programs oriented toward a high percent coverage and long-term effectiveness. Presently, many water conservation programs achieve a relatively low percentage penetration (e.g., 20-30% of existing households) and utilize conservation devices with limited life spans. To really reap the benefits of municipal water conservation, program designs must be developed which are cost-effective and socially acceptable and, at the same time, achieve high percentages of penetration with essentially permanent devices or improvements. (See also W87-08420) (Lantz-PTT)
W87-08447

DEVICES AND TECHNOLOGIES FOR WATER CONSERVATION - STATE OF THE ART: STANDARDS FOR INDUSTRY,
Waltec, Inc., Wallaceburg (Ontario).
J. A. Burgess.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 269-271.

Descriptors: *Water conservation, *Standards, *Canada, *Waterloo, *Yukon, Planning, Plumbing, Flow regulators.

The United States and Canada share the largest freshwater system in the world, the Great Lakes. Both east and west of the Great Lakes, river systems form or cross the international border. It is natural that the two countries share similar problems in dealing with a shared natural resource. There are also many differences due to Canada's substantial freshwater lakes and streams, in addition to the Great Lakes, and also due to a much lower density of population and to the special problems of the Far North. Both countries face the economic factors of increasing energy costs, the treatment of wastewater, and the capital cost of expanding water supply and disposal systems. A recent study done by the Canadian Department of the Environment, which identifies a few problem areas, and also another recent study under the auspices of the Canadian Standards Association, will be reviewed to see if reduction in maximum flow rates for plumbing fittings would help solve certain municipal supply problems. The Federal Department, Environment Canada, supports research including many river basin planning studies and university research projects. In addition, they have special projects dealing with water supply use, and conservation in the Yukon and Northwest Territories where, because of low precipitation and extreme climatic conditions, it is difficult to transport water and dispose of wastes for many months of the year. In the regional municipality of Waterloo, an industrialized are 60 miles west of Toronto, they have depended on groundwater sources rather than piping water in from the Great Lakes, as has been done in other communities in the area. They have also experienced periodic shortages. The region has done a comprehensive study of conservation and has developed standards for water-efficient plumbing devices. The regional government offers grants to encourage builders to fit new structures with toilets, showerheads, and faucets that comply with their criteria. Studies conclude that an effective water conservation program must include the following elements: (1) water meters, with bills; (2) conservation programs must be developed for industry; (3) domestic use of water is time related, therefore a reduction in flow rates could result in water savings; (4) user satisfaction and long-term, trouble-free service life must be maintained in water conservation products if consumer support is to be sustained. (See also W87-08420) (Lantz-PTT)
W87-08448

PERFORMANCE REQUIREMENTS AND TEST PROCEDURES FOR WATER CLOSETS,
Stevens Inst. of Tech., Hoboken, NJ. Davidson Lab.
T. P. Konen.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 273-280, 4 fig.

Descriptors: *Performance evaluation, *Testing, *Water closets, Sanitation, Plumbing, Water conservation.

A study has completed the development of requirements and procedures for evaluating the sanitary performance of water closets. This effort was undertaken in conjunction with the U.S. Department of Commerce - National Bureau of Standards and the U.S. Department of Housing the Urban Development. The overall objective of their program is to provide technology to achieve a significant reduction in residential water use. The objective of the study was to develop test methods for use by industry, code groups, enforcement agencies and others to determine the functional performance of water closets and thereby provide safe and efficient designs and installations. This activity has paralleled the development of the proposed revision to the American National Standard A112.19.2 - Vitreous China Plumbing Fixtures. The opportunity to incorporate these findings into the product standard has added to the significance of this program. A review of the present techniques found many of the major producers using test media spanning a wide range of size, form and density. Little information was found within the industry as to the characteristics of waste products; however, an electronic search of biology and medical journals produced several interesting studies which led to the selection of the test media. In addition to physical simulation, the media must lead to repeatable and discriminatory tests. The primary characteristics of the water closets for which test methods and procedures were developed include: surface cleansing, waste removal, including solids and liquids, and volumetric efficiency. As a service to industry and the general public, the Laboratory makes available a test kit which includes the media (for either the ball test, 100 3/4 inch polypropylene balls; the granule test, 100 ml of 2-3 mm diameter disc shaped polyethylene granules; and the cylinder test - four 1 inch latex cylinders), instructions and data sheets. (See also W87-08420) (Author's abstract)
W87-08449

EXPERIENCES AND BENEFITS OF THE APPLICATION OF MINIMUM FLOW WATER CONSERVATION HARDWARE,
Weatherby Associates, Inc., Jackson, CA.
L. K. Baker.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 281-288, 11 tab, 7 ref.

Descriptors: *Water conservation, *Flow regulators, *Flow control, Plumbing, Domestic water, Sewer systems, Flow reduction.

Minimum flow water conservation is achieved by using hardware and techniques specifically designed around minimizing consumption while maintaining the function, both physiological and aesthetic, of the use as opposed to modification or redesign of existing hardware and fixtures. These techniques and hardware have been used to significantly reduce water and energy consumption and sewage treatment and disposal problems in both commercial and residential applications. This paper presents results of these applications with over an 80% reduction in water consumption in commercial and 60% in residential applications. Impacts on sewage systems have been observed and projected for both on-site and central systems. Reductions in plumbing and water heating facilities are also discussed. (See also W87-08420) (Author's abstract)
W87-08450

TECHNICAL REQUIREMENTS FOR LOW-FLOW DEVICES,
Delta Faucet Co., Greensburg, IN.
F. R. Holycross.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 289-292.

Descriptors: *Water conservation, *FLow regulators, *Plumbing, Flow control, Flow rates, Water transport, Water pressure.

There are many technical problems that as manufacturers of plumbing products, one becomes aware of. Low flows, pressure fluctuations, pressure regulations, solids transportations, ad infinitum. Individually and collectively, some answers to these problems have been found. Some of these answers are available now, to put to use. However, there are some problems that cannot be answered because of the confusion in codes. Where a solution is good in one code area it may not apply in another area. The systems of today do not lend themselves to solutions based on new system types. At the moment there are many areas which have flow rate limits while many other areas have no such requirements. Enforcement of the flow rate requirement is not at all well done, where low flows are mandated. However, at the present time, with some areas of the United States requiring flow limiting and with other areas not wanting it, some manufacturers make two versions of each faucet. One, unlimited as they have always been, and another almost identical to the first except that it is flow limited. The flow-limited version is manufactured to a specified flow rate or to a standard adopted by several code agencies. Another difficulty is that the water transport systems are totally integrated. From source through disposal, one component cannot be appreciably altered without upsetting the system. Manufacturers, are more than slightly aware of this. One major aspect of this total system is the volume of water required to move solid waste through the drainage component. While fitting manufacturers can produce variety of low-flow fittings and fixture manufacturers can produce low-volume-usage fixtures, there is a limit to these reductions for adequate drainage through in-place systems. For years, it has been possible to make water closets that flush on very little water. Another large problem which exists is flow limiting of showers. Where before the limiting requirement, a pressure fluctuation of 10 psi, did not cause too much temperature change, that same 10 psi change now can cause as much as a 25 F change in outlet temperature. (See also W87-08420) (Lantz-PTT)
W87-08451

MODEL FOR THE TRANSPORT MECHANISMS OF SOLIDS IN BUILDING PIPE DRAINS,
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
For primary bibliographic entry see Field 5F.
W87-08452

DEVELOPING DATA FOR RESIDENTIAL WATER SAVINGS,
Brown and Caldwell, Walnut Creek, CA.
W. O. Maddaus, and J. H. Rothenberg.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 329-337, 6 ref.

Descriptors: *Water conservation, *Data acquisition, *Domestic water, Field tests, Cost analysis, Plumbing, Metering, Leakage.

Demonstration projects are being conducted for the U.S. Department of Housing and Urban Development (HUD) to document water savings in actual homes. Arrangements to conduct demonstration projects have been made with the City of Atlanta Bureau of Water, Denver Water Board, Los Angeles Department of Water and Power, and the Washington Suburban Sanitary Commission. Projects were selected on the basis of estimated water savings, need for field data, cost, and other factors. The following demonstration projects were selected: studies of contemporary and advanced low-water-using bathroom fixtures; a study of water- and energy-efficient homes; the effect of retrofitting on hot water and energy use; the effect of metering; the effect of a pressure change; a nationwide leak detection survey; nationwide surveys of water-using fixture use and shower water use characteristics; and the long-term effectiveness of retrofitting in various cities. Each project involves a test group of dwelling units, equipped with the water conservation device, and a control group for comparison. Results were published in 1982 and 1983. (See also W87-08420) (Author's abstract)
W87-08453

HOW TO IMPLEMENT A WATER CONSERVATION PROGRAM - THE DENVER EXPERIENCE,
Denver Water Dept., CO.
J. J. Wilder.
IN: Proceedings of the National Water Conservation Conference on Publicly supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 339-346.

Descriptors: *Water conservation, *Denver, *Colorado, Water supply, Public participation, Public relations.

The need for Water Conservation in the Denver metropolitan area is nothing new. Denver residents receive high-quality water from a complex, well-planned system. Some of the water travels as far as 120 miles through tunnels by gravity flow under the Continental Divide before reaching Denver's treatment plants. This vast and complex mountain system does not deliver a major amount of the State's water to Denver; on the contrary, the entire metro Denver area uses only 1-1/2% of the total annual State yield. But, just collecting that small amount requires engineering skill and long-range planning often not required in other sectors of the country and, of course, considerable expenditure in dollars. Even though Denver has expanded this excellent water system through the years to increase the supply, water conservation has been a watchword through the years as residents struggled to create some of the amenities of an urban environment -- every tree, bush and blade of bluegrass had to be planted. Working on the theory that 'preaching water conservation may fail because people don't respond to a long list of do's and don'ts, the Denver Water Department produced a 7-minute animated film aptly named 'Water Follies'. The colorful animation with a catchy sound track using no words, has proved universally popular. As a companion piece to the film, Denver produced a colorful brochure listing 44 ways to be 'water wise'. Most of the worthwhile water conservation ideas for the semi-arid West are listed. It has been furnished on request to areas far beyond Denver's service area. Three years ago, the Department's Public Affairs Department hired a certified teacher and now offers a complete classroom program for any fifth or sixth grade and high school class in the metro area. The youngsters enter wholeheartedly in discussion and experiments on water. A speakers' bureau prepares programs for civic groups, garden clubs, service clubs and neighborhood associations utilizing the film, brochures and a speaker with a conservation message. Building on its existing conservation program, the Department will attempt to meet its goals through a program that will include: an expanded public education and information program; expansion of the school program; affixing of water consumptive use indices to all plumbing fixtures and water-using appliances solid in the Denver area; identifying water requirements of landscape nursery stock; and many other techniques and devices to improve public awareness and participation. (See also W87-08420) (Lantz-PTT)
W87-08454

KEYNOTE ADDRESS,
Corps of Engineers, Washington, DC.
E. R. Heiberg.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 355-363.

Descriptors: *Water conservation, *Water resources development, *Water supply, Resources development, Management planning, Water management, Public participation.

The water resources program of the Corps of Engineers has made a tremendous amount of water

supply storage available to non-federal interests. About 8 million acre-feet (10 billion cubic meters) of storage is under contract, and another 12 million acre-ft (15 billion cu m) is part of existing and authorized projects. The President's declaration of a national emphasis on water conservation has resulted in changes in water supply planning that will improve the Nation's economic welfare and enhance its environment. The Corps has set forth a definition, principles, and procedures for evaluating water conservation that will ensure consistent and balanced treatment of water conservation and supply augmentation. The Corps is implementing a plan of action that will integrate water conservation into all aspects of its civil program. The water resources program is seldom static, and active consideration is being given to potential changes in the federal role in water supply/conservation. The pressures to expand the federal role are being met with strong resolve by others to retain or even reduce the present federal role. Additional time will be required before the complex critical issues associated with this question can be resolved and the federal role of the future established. (See also W87-08420) (Lantz-PTT)
W87-08456

COMPARISON BETWEEN WATER CONSERVATION PRACTICES IN THE UNITED KINGDOM AND THE UNITED STATES,
Thames Water Authority, Reading (England).
D. G. Jamieson, and G. S. Million.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 367-372.

Descriptors: *Water conservation, *England, *Water resources development, *Wales, Water supply, Water use, Flow regulators, Legal aspects, Comparison studies, Plumbing.

During recent years, there has been a growing awareness, on both sides of the Atlantic, for the need to conserve resources. In the specific case of water conservation, there has been little exchange of information and, as a result, ideas have largely developed independently. The purpose of this paper is to draw comparisons between conservation activities as practiced in Britain and in the United States. Its intention is to cover both aspects of water conservation; namely, demand management and supply management, with a view toward acquainting the readership with British practices as adopted by the Thames Water Authority, and to suggest reasons for the difference between the United Kingdom and the United States in terms of attitude, emphasis, and outcome. Obviously, any comparison of this nature is bound to be superficial; in this particular instance, the tenuity is compounded by a limited knowledge of American culture and practices. Nevertheless, the apparent difference in terms of per capita consumption is so marked that the lack of precise detail should be incidental. Although consumption rates in Britain are significantly lower than in the United States, there is no room for complacency. Consequently, all water authorities now have, or will soon have, bylaws that make dual-flush mandatory for the washdown type of toilet in all new dwellings. Similarly, some water authorities have ongoing programs of research to establish the effectiveness of variable-flush toilets, pressure-reducing valves, flow-limiting valves, automatic flushing control, etc. It has been recognized for some time that there is a need to review the whole framework of model bylaws in England and Wales with the aim or promoting more prudent use of water. In the near future, the expectation is that proposals will be put forward to the National Water Council and the Department of the Environment for consideration on a national basis. Although the potential savings from the measures proposed in the new model, bylaws cannot be quantified with any certainty, they will provide a climate conducive to creating a water-conscious society. (See also W87-08420) (Lantz-PTT)
W87-08457

FEDERAL WATER RESOURCE AGENCY PLANNING REQUIREMENTS AND IMPLICATIONS FOR WATER CONSERVATION,
Water Resources Council, Washington, DC.
For primary bibliographic entry see Field 6B.
W87-08458

PLUMBING CODES - ESSENTIAL IN WATER CONSERVATION PROGRAMS,
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
L. S. Galowin.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 379-397, 21 ref, 2 append.

Descriptors: *Water conservation, *Plumbing, *Plumbing code, Standards, Flow regulators, Flow control, Pipes, Water demand, Water supply.

The development and implementation of water conservation programs requires acceptance of low water usage plumbing fixtures and devices. The installation of innovative components or modifications to existing plumbing systems for reduced water consumption are controlled by local jurisdictions through the plumbing codes. A review of the developments leading to current plumbing code requirements is presented. The basis for development of revisions to codes and supporting standards from current research projects is discussed. Requirements are indicated for: (a) current data based upon real water demand loads to update water supply pipe sizing (Hunter's Curve); and (b) the necessity to consider the impact of deterioration of performance from reduced wastewater flows in the building drainage system with expanding water conservation practices. Examples of laboratory research and field demonstration of water conservation programs are provided. (See also W87-08420) (Author's abstract)
W87-08459

WATER CONSERVATION IN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
R. B. Robie.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 401-407.

Descriptors: *Water conservation, *California, *Water supply, Public participation, Education, Rates, Cost analysis, Leakage.

California's resource planning includes water conservation as a source of supply. By the year 2000, the State expects water savings of about 1.5 million cubic dekameters/yr. Department of Water Resources (DWR) conservation activities are centralized in its Office of Water Conservation (OWC). Programs are in three major categories -- agricultural, urban, and in-school education. The largest urban program is distribution of residential water conservation devices. By the end of 1982, all those living in homes built before water conserving fixtures become mandatory had been given devices. The Department works with other state agencies to save water, develops water conserving landscape gardens, encourages water conserving pricing, has a grant program for water system leak detection and works to build water conservation into local planning. Elementary school programs train teachers and make curriculum materials available. Education activities include a newsletter, drought and water conservation related reports and brochures. The Department reports on comparative water conservation performances of selected communities in the State. (See also W87-08420) (Author's abstract)
W87-08460

NEED FOR A NEW FEDERAL WATER POLICY,
New York City Dept. of Environmental Protection.
For primary bibliographic entry see Field 6E.
W87-08461

LOCAL RESPONSE FOR OFFICIALS AND CONSUMERS,
Denver Water Dept., CO.
W. H. Miller.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 413-417.

Descriptors: *Water conservation, *Public policy, *Local governments, *Water use, Regional planning, Water supply, Water demand, Precipitation.

Water conservation is perceived differently in various parts of the nation. In the Rocky Mt. West, the goal is to catch runoff from the mountains in the spring and 'conserve' it by storing it in reservoirs for use the rest of the year. In some Coastal states, the goal is to conserve fresh groundwater by preventing saltwater intrusion. In some older Eastern seaboard cities, a key conservation concern is renovation of antiquated, deteriorating underground piping systems. In major river basins and the Great Lakes area, where supply is no problem, demand for water conservation might well be countered with the question, 'Why'. Therefore, it is difficult to mount a nationwide, federally endorsed conservation program. Perhaps the common denominator is an economic one: does it make dollars--as well as sense--to conserve. While conservation can be an important step in reducing demand on some municipal systems for specific periods of time, it cannot, in the long run, serve as a substitute for the development of adequate water supplies to meet the needs of the people served by these systems. Possibly the best conservation practice would be better utilization of the water the nation receives in the form of precipitation. Surveys indicate that 92% of the precipitation that falls on the nation either evaporates immediately or runs off to the oceans unused. Putting some of this water to beneficial use may represent one of the great conservation challenges of the future. (See also W87-08420) (Lantz-PTT)
W87-08462

FUTURE LOOK - WHAT ARE THE UNKNOWNS,
American Water Works Association, Denver, CO.
J. B. Gilbert.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 421-425.

Descriptors: *Water conservation, *Local governments, *Federal jurisdiction, Water supply, Cost analysis, Rates, Regional planning.

In 1977, 1978, and 1979, politicians and officials tried to solve the problem of water conservation in the context of impending doom. There were many local water shortage problems, with the Federal Government desiring an immediate maximum regulatory effect. This led to the counterreaction that is now beginning in the new administration. At the risk of speculation in this area, it seems unfortunate that one goes between these extremes when it applies to water conservation or any other resource matter. Conservative and liberal conservationists show a sensible and justified concern for efficient water use, and everyone wants to achieve these goals just as rapidly. But the crash program approach of the last decade, using maximum regulations and employing all the tools available, inevitably provoked the current counterreaction. The philosophy that the role of Federal and State governments should be minimized, or eliminated, in these areas and that the local people should decide what to do, is a reality that must come to be recognized. Emphasis on the regulatory approach should be limited. It is hoped that it will be limited, because more progress can be made that way. An increased emphasis on the regional sharing of existing water supplies is vital, with less emphasis being placed on certain fixed or standard objectives for

water conservation. In regard to pricing and subsidies for water conservation, it is generally believed that the cost of water is the key factor in providing for efficient use. New technologies can be employed, and the public can be educated, but in the end, if the cost is high, as is currently the case with energy, the result will be a substantial reduction in consumption. Water savings in the utility context must be evaluated on a geographical basis, and the balance between achieving efficient use through rates or policies is a critical factor. (See also W87-08420) (Lantz-PTT)
W87-08463

APPRAISAL OF 1978 CONFERENCE CASE HISTORY: DO THE BENEFITS ENDURE,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 6B.
W87-08464

CONSERVATION IN A NONCRISIS ENVIRONMENT - TOWNSHIP OF EAST BRUNSWICK, NEW JERSEY,
East Brunswick, NJ.
L. M. Neely, M. J. Opaleski, T. B. Shelton, and D. Palmini.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 433-441, 4 tab, 4 ref.

Descriptors: *Water conservation, *East Brunswick, *New Jersey, Water storage, Water supply, Water distribution, Cost analysis, Economic aspects, Municipal water.

East Brunswick Township is a suburban community of 38,000 located midway between New York City and Philadelphia. East Brunswick's socioeconomic standing is the highest in the county and ranks No. 4 in the United States based on the standard metropolitan statistical area. The municipality's water system consists of many parts incorporated into one major system. The facility consists of one ground treatment plant, a pumping lift station for purchased supply, and three elevated and one ground storage tank connected through 200 miles of pipe ranging from 4 inches to 30 inches. Currently, the system treats and delivers an average of 4.5 million gallons/day (Mgal/d). The distribution system is relatively new, and the majority of the piping has been installed within the last 40 years. Some piping installed over 80 or 90 years ago is still being used. The Township is 21 sq mi and 60% developed. The present system service base consists of 9,608 residential and 807 industrial accounts, for a total of 10,415. Most are residential accounts and account for 92% of use. Water conservation directed at the industrial/commercial enterprises would be short sighted. The Conservation Program was developed for residential use. The system is 100% metered, and the unaccounted-for water is incurred by theft (unauthorized hydrant use by road contractors) and water main breaks. All nonrevenue usage such as main flushing, street sweeping, and normal everyday activities by the municipality (hydrant repair, sewer main cleaning, storm sewer cleaning, and street sweeping) are metered or calculated. The unaccountable loss of water within the distribution system is 8%. A system is considered tight if loss is in the range of 10-15%. The conservation program cost the Township $5,606, giving a cost per 1,000 gallons saved per year of $1.98. This should more reasonably be amortized over the lifetime of the water-saving devices, about 10 years, giving a cost per 1,000 gallons saved of 19.8 cents. (See also W87-08420) (Lantz-PTT)
W87-08465

CASE STUDY - IN-SCHOOL WATER CONSERVATION EDUCATION PROGRAM,
California State Dept. of Water Resources, Sacramento.
S. Butterfield.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 443-447.

Descriptors: *Water conservation, *Education, *Case studies, *California, Training.

California's in-school water awareness and conservation program for kindergarten through eighth grade students offers special curriculum materials and teacher training. Children are the greatest resource of the future and must learn to be wise consumers and citizens in order to make informed decisions when adults. The program teaches water's vital role in life, and that this resource is limited. A secondary benefit occurs when children carry water conservation messages home. Materials are available for the entire kindergarten through eighth grade spectrum, and as a result of evaluations, 4-6 grade materials are now emphasized. The program is continuous, not just a one-time informational campaign. With a small budget and staff, 10% of the total elementary grade population has been reached in the last three years. (See also W87-08420) (Author's abstract)
W87-08466

CASE STUDY - DISTRIBUTION OF RESIDENTIAL WATER SAVING DEVICES,
California State Dept. of Water Resources, Sacramento.
S. Butterfield.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 449-452.

Descriptors: *Case studies, *Water conservation, *Flow regulators, *California, Plumbing, Cost analysis, Economic aspects, Education, Distribution.

A state-wide program of distributing water conservation devices to residents of the State of California, is to be completed by 1983, and to result in annual savings of about 58,000 acre-feet of water and the energy equivalent of 1.3 million barrels of oil. Savings pay for program costs in about three months. Distribution programs began in 1977 with pilot studies resulting in the present program configuration that is based on mass mailing of kits containing displacement bags and shower flow restrictors. All programs are cooperative with local agencies and tailored to local situations, and are accompanied by an advertising campaign and in-school education programs. Detailed reports on past programs are available. (See also W87-08420) (Author's abstract)
W87-08467

RESULTS OF A PEAK MANAGEMENT PLAN FOR TUCSON, ARIZONA,
Tucson, AZ.
For primary bibliographic entry see Field 6B.
W87-08468

WATER CONSERVATION EFFORTS IN RURAL AREAS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
A. R. Rubin.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 465-469.

Descriptors: *Water conservation, *Rural areas, *North Carolina, Water resources development, Education, Public participation, Water supply, Domestic water.

North Carolina is predominantly a rural state. Recent census figures indicate that the rural counties in the eastern and western parts are growing at a more rapid rate than are the more urbanized counties in the central part of the State. Nonetheless, major population centers do lie along the interstate highway routes that link Charlotte in the west with the Raleigh-Durham area in the east. Almost half of the State's population reside in this area known as the Piedmont Crescent. Historically, the water resources base that supports these areas has been adequate; however, with increasing population pressures, rapid industrial development, concomitant industrial development pressures, agricultural water uses, and commercial uses of water, the future availability of these once plentiful water resources is now being questioned. Working cooperatively with the Water Resources Research Institute of the University of North Carolina, the Agricultural Extension Service sough a Title V grant from the Rural Development Panel to establish a pilot water conservation, water supply, and wastewater management program, general water resources education program, and to incorporate such a program into the administrative and operational structure of the North Carolina Cooperative Extension Service. The major goals of this program were to facilitate the development, implementation, and evaluation of cost-effective water supply and wastewater management systems for both individuals and small rural communities. Three areas of concern emerged in the area of water conservation: technical, institutional, and behavioral concerns. A demonstration water conservation effort then began in the State with which both the urban and the rural residents could identify. This program focused on the technical and the behavioral aspects of a water conservation program. This initial effort was directed at determining the hardware and determining individual water-using behaviors and habits. Significant results were obtained in these pilot efforts, and average residential water savings amounted to over 1,500 gallons/month for a family of four. (See also W87-08420) (Lantz-PTT)
W87-08469

WATER CONSERVATION/FLOW REDUCTION IN FACILITIES PLANNING FOR SALT LAKE COUNTY,
Kapaloski, Kinghorn and Alder, Salt Lake City, UT.
G. H. Kinghorn.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 471-477.

Descriptors: *Water conservation, *Salt Lake County, *Utah, Municipal water, Water systems, Drinking water, Legislation, Regulations, Flow reduction.

Salt Lake County is an urban county in Utah with a 1980 population of 620,000. Twelve municipalities are incorporated within Salt Lake County including over 40 public water systems. Fourteen wastewater collection entities, ranging from municipal systems to dual-purpose improvement districts, to single-purpose 'county service area' entities, collect wastewater for disposal at nine treatment facilities and one dual-purpose lagoon. An areawide plan was completed in 1978 that provided for consolidation of seven treatment facilities into two larger 'regional' facilities. The remaining treatment facilities were projected for further planning. The 1977 amendments to the Federal Water Pollution Control Act (FWPCA) introduced a new requirement into the facilities planning process required by Title II of the FWPCA. The new requirement was an amendment to Section 204(a)(5) and provided that reserve capacity designed into treatment works would be approved after the assessment of possible flow reductions resulting from water conservation efforts approved under regulations to be developed by the EPA. Local officials from one of the treatment entities in Salt Lake County, the South Valley Water Reclamation Facility Board, had contracted for engineering services prior to receiving the policy of EPA on the water conservation/flow reduction issue, and a water conservation/flow reduction plan was not part of the contract. EPA, through the Region VIII office, adopted the policy that a Step I facilities plan could not be approved for grant funding until regulations were developed and in place providing detailed law guiding engineering and grant approval. Faced with a potential delay in grants for construction planning, over-

loaded treatment pants, a rapidly growing population, and record-high construction costs, local officials were disappointed and angry. This article describes how the Regional EPA staff, Utah State officials, and local officials worked together to plan a water pollution improvement project in compliance with the water conservation mandate of the 1977 amendments to the Clean Water Act. The selected program is also described together with the process for planning the selected program. (See also W87-08420) (Lantz-PTT)
W87-08470

USE OF WATER IN ADRIATIC COASTAL TOURIST SITES,
Zagreb Univ. (Yugoslavia). Faculty of Civil Engineering.
For primary bibliographic entry see Field 3C.
W87-08556

3E. Conservation In Industry

PERIODIC OPTIMAL CONTROL WITH APPLICATION TO PUMPED STORAGE PLANTS,
Israel Electric Corp. Ltd., Haifa.
For primary bibliographic entry see Field 8C.
W87-08329

3F. Conservation In Agriculture

SPRINKLER AND DRIP IRRIGATION SYSTEMS: A DETAILED OVERVIEW,
R. C. Smith.
American Nurseryman, Vol. 163, No. 6, p 68-70, 72-74, 78, March 1986. 1 fig, 1 tab.

Descriptors: *Sprinkler irrigation, *Drip irrigation, *Reviews, *Irrigation design, *Irrigation engineering, Technology, Installation, Irrigation, Irrigation practices, Climatology, Topography, Soil types, Water quality, Legal aspects, Regulations, Marketing, Pipes, Construction, Control systems, Engineering, Hydraulic engineering, Safety, Nozzles.

The design and installation of sprinkler and drip irrigation systems is reviewed. Site-specific factors influencing system performance include climatic conditions, ground slope, soil type, state and local regulations, water quality, and the kind of plant material that is being installed. Common problems are discussed, including those that arise from inaccuracy in the original design. Other topics covered include (1) enhancing marketability of irrigation systems by minimizing damage to the client's property during trenching; (2) proper placement of sprinkler heads; (3) technological innovations such as controllers and drip-system components; and (4) flow restrictions. Finally, hints are provided for maintaining successful business relations with clientele: (1) keep a clean job site; (2) practice job safety; (3) keep the client informed as the job progresses; (4) review the system operation with the client upon completion and follow through with winterizing of the system in the fall; (5) give the client a copy of the plan and keep one on file for service calls; and (6) negotiate satisfactory payment schedules. (Doria-PTT)
W87-07605

TRICKLE IRRIGATION: IS IT FOR YOU,
S. D. Verkade, and G. E. Fitzpatrick.
American Nurseryman, Vol. 163, No. 11, p 114-116, 118-120, June 1986. 1 fig, 2 tab, 4 ref.

Descriptors: *Trickle irrigation, *Crop production, *Water conservation, *Irrigation efficiency, Pipes, Technology, Irrigation, Fertilizers, Pesticides, Agricultural chemicals, Conservation, Irrigation practices, Irrigation operation, Irrigation design, Filters, Water shortage, Energy.

The advantages and disadvantages of trickle irrigation are reviewed. There has been a recent trend for nurseries to use low-pressure trickle or drip irrigation instead of overhead irrigation. Trickle irrigation uses a series of pipes, tubes, and emitters to apply water more precisely to specific zones around plants. These systems use less water pressures and volumes, and are especially appropriate for field production and for plants in large containers. Topics discussed include the components of the system; the importance of water quality; measurement of residual free chlorine; use of backflow protection devices when applying agricultural chemicals; use of filters to reduce levels of suspended material in lines; use of pressure-flow control regulators; use of controllers; selection of piping sizes and types; and management of the system after it is in place. Trickle systems reduce water use by up to 75%, minimize runoff, and save up to 85% of energy costs while increasing application efficiency. The major disadvantages are clogging of emitters and the lack of spacing flexibility. (Doria-PTT)
W87-07606

HOW TO HANDLE A BOUT WITH DROUGHT,
Tennessee Technological Univ., Cookeville.
D. L. Airhart, and T. J. Hall.
American Nurseryman, Vol. 164, No. 2, p 53, 56-59, July 1986. 13 ref.

Descriptors: *Drought, *Water management, *Water shortage, *Water stress, *Water conservation, *Crop production, Resources management, Water supply, Soil water, Soil-water-plant relationships, Agriculture, Irrigation, Drip irrigation, Trickle irrigation, Mist irrigation, Conservation, Surfactants, Mulches, Evapotranspiration control, Fertilization, Weed control.

The effects of drought on plants are discussed, along with tactics for combating the situation. Severe reductions in soil moisture may cause permanent wilting, reductions in growth parameters, and decreased plant quality and value. Reducing the effects of drought can be accomplished by conserving soil moisture and using irrigation techniques. Measures discussed include overhead sprinkler systems; irrigation timing; use of surfactants; use of contour rows in the field, cover crops in the aisles, and no-till or minimum tillage; mulching; use of poly films; shading plants with cloth or other material; and use of misting systems. Additional practices include light pruning to reduce evapotranspiration losses, selective thinning, and weed control. Fertilization during drought may be hazardous, and antitranspirants, while they reduce plant moisture requirements, may damage or weaken plants. (Doria-PTT)
W87-07607

CANOPY TEMPERATURE OF SUGARCANE AS INFLUENCED BY IRRIGATION REGIME,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 2I.
W87-07610

USE OF RAINFALL FORECASTS IN THE OPTIMAL MANAGEMENT OF SMALL-HOLDER RICE IRRIGATION - A CASE STUDY,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W87-07612

CROP SELECTION AND MANAGEMENT,
California Univ., Davis. Dept. of Agronomy and Range Science.
For primary bibliographic entry see Field 3C.
W87-07668

IRRIGATION SYSTEM DESIGN,
California Univ., Davis. Dept. of Civil Engineering.
R. G. Smith, J. L. Meyer, G. L. Dickey, and B. R. Hanson.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 8-1 to 8-61, 5 fig, 20 tab, 22 ref.

Descriptors: *Impaired water use, *Water reuse, *Irrigation practices, *Design standards, *Irrigation programs, Reclaimed water, Wastewater irrigation, Storage, Irrigation requirements, Irrigation efficiency, Agriculture.

Irrigation system design, as presented in this chapter, is divided into three major steps. The first two steps (land area and storage requirements, and irrigation requirements and scheduling) are described in detail because they involve design decisions that are unique to irrigation with reclaimed wastewater. The third step--detailed design of distribution and drainage system components--can be performed following conventional irrigation system design procedures. Production of a marketable crop is considered to be a principal objective of the reclaimed-wastewater system. Procedures in Step 1 design depend on the amount of water applied relative to the water needs of the crop. For design purposes, systems are categorized as Type 1 or Type 2 based on the following definitions. Type 1--systems designed to apply just enough water to meet the total irrigation water requirements of the crop, which include crop needs plus allowances for distribution system efficiency. Type 2--systems designed to apply water in excess of the total irrigation water requirements of the crop. (See also W87-07662) (Lantz-PTT)
W87-07670

HUMID REGIONS: CONSERVATION NEEDS AND TECHNOLOGY ON AGRICULTURAL LAND,
Ohio Agricultural Research and Development Center, Wooster.
D. M. Van Doren, H. L. Barrows, O. P. Engelstad, G. R. Foster, and E. J. J. Koos.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc., Madison, Wisconsin, 1981. p 41-61, 1 fig, 5 tab, 5 ref.

Descriptors: *Water conservation, *Soil conservation, *Humid climates, *Research priorities, *Crop production, Cultivation, Erosion control, Soil erosion, Land use, Water management, Soil management, Farm management, Drainage engineering, Drainage terrace, Land reclamation, Crop yield.

The total land available for cropland and pasture in the humid region of the United States is continually being irreversibly reduced by conversion to uses for transportation, urban development, erosion, and water. Water supply for crop production in the humid region has historically been derived primarily from precipitation and water stored in the soil without recourse to irrigation. As demand for U.S. agriculture increases, several agricultural production technologies will need improvement. Soil erosion control should be based on maintenance of a cover of plant material (residue), alive or dead, on the soil surface at all times along with special conservation tillage techniques. Farm equipment should be modified to operate in accord with conservation tillage technologies. Plant breeders need to select varieties that can grow on residue-covered soil. Integrated pest management holds promise for more effective use of pesticides and greater acceptance for conservation tillage technologies. Conservation tillage systems where plant residues are maintained on the soil surface can lead to reduced runoff and evaporation of precipitation. The more successful new technologies develped for soil and water conservation will be those providing the greatest flexibilty in the timing of production operations. Other research priorities are to improve the capability to inventory and predict the effect of climate, soil, topography, land use and management on soil productivity and soil degradation from erosion, compaction crusting, and loss of organic matter and nutrients. New soil- and water-conserving technologies are also needed for land-use conversion. (See also W87-07680) (Geiger-PTT)
W87-07683

SEMI-ARID AND ARID REGIONS: CONSERVATION NEEDS AND TECHNOLOGY ON AGRICULTURAL LAND,
Agricultural Research Service, Temple, TX.
E. B. Burnett, R. J. Hanks, R. R. Allmaras, J. J. Bond, and D. G. Hanway.
IN: Soil and Water Resources: Research Priorities

for the Nation, Soil Science Society of America, Inc, Madison, Wisconsin, 1981. p 63-81.

Descriptors: *Arid lands, *Semiarid lands, *Crop production, *Soil conservation, *Water conservation, Irrigation efficiency, Erosion control, Soil erosion, Farm management, Water management, Soil management, Research priorities, Wind erosion, Cultivation, Drought resistance, Dry farming.

To increase soil productivity and crop yield in semiarid regions using dryland farming, several measures should be adopted including the use of crop residues to reduce evaporation, the selection of drought resistant plants, the use of conservation tillage methods, and the planting of legumes to reduce the need for nitrogen fertilizers. Mathematical modeling and field experimentation should be conducted to evaluate the relationship between cumulative soil loss and productivity. In semiarid regions using irrigated agriculture, there is a need for more efficient use of irrigation water. This need may be met by better irrigation equipment, more efficient fertilization schedules, better timing of crop irrigation, and better ways to evaluate soil salinity. Proper management of residue on the field can effectively control wind and water erosion. Use of herbicides must be integrated into irrigated crop production systems along with tillage, fertilizer, and water application procedures. Other research priorities include the development of new technologies to cope with production in stressed environments and conservation production systems for improved farm management. (See also W87-07680) (Geiger-PTT)
W87-07684

POLICY: ALTERNATIVES AND CONSEQUENCES OF CONSERVATION TECHNOLOGY ON AGRICULTURAL LAND,
Wisconsin Univ.-Madison. Coll. of Agricultural and Life Sciences.
S. C. Smith, D. Allee, S. S. Batie, A. C . Basu, and C. Benbrook.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc, Madison, Wisconsin, 1981. p 83-101, 6 ref.

Descriptors: *Soil conservation, *Water conservation, *Water policy, *Research priorities, *Soil erosion, Water management, Soil management, Crop production, Farm management, Political aspects, Public policy, Land use, Economic aspects, Institutional constraints, Policy making.

The present structure of conservation policy institutions were affected by situations in the 1930's. As soil and water conservation programs are shaped for the future, the transition from low-cost oil and electricity to high-cost power, with possible supply disruption, must be taken into account. Proposed research has three key elements: institutional options and performance evaluation of alternative policy instruments; effect of policy instruments on farm adoption rates of soil conservation practices; and policy and institutional studies growing out of the indirect effects of soil conservation on water resources. A basic goal of research on the political support base for conservation is to gain a better appreciation of the relative importance that should be given to attainment of the many different social objectives affected by conservation activities. Two categories of institutional alternatives should be considered: a vertical slice through the agency structure (federal, state, and local), and various institutional options at a particular level of government. Instruments influencing the conservation decisions of individual land managers (cost-sharing, regulation, technical assistance, tax incentives, cross-compliance, and education) must be compared to determine any performance differences that may be linked to structure. Four research elements are identified for considering farmer adoption of conservation practices: the effects of soil erosion on agricultural productivity; farmer perceptions of soil erosion on productivity; factors affecting the gap between measured and perceived effects of soil erosion on productivity; and the effects of fiscal, monetary, sector (agriculture and energy) and soil conservation policies on the adoption of conservation practice. Three research elements are identified for considering the indirect effects of soil conservation on water resources: the effects of alternative soil conservation practices on different water users, erosion control-water quality policy options, and institutional options. (See also W87-07680) (Geiger-PTT)
W87-07685

RANGELAND: CONSERVATION NEEDS, TECHNOLOGY, AND POLICY ALTERNATIVES,
Humboldt State Univ., Arcata, CA. School of Natural Resources.
D. W. Hedrick, J. L. Schuster, F. Busby, C. H. Herbel, and G. Kearl.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc, Madison, Wisconsin, 1981. p 127-140, 3 ref, 8 ref.

Descriptors: *Range management, *Research priorities, *Soil conservation, *Water conservation, *Soil erosion, Range grasses, Pastures, Grazing, Policy making, Land use, Resources management, Soil management, Water management, Productivity, Water use efficiency, Forages.

Rangeland, which makes up nearly two thirds of the land in the United States, is used as a source of forage, cover, water, and space for domestic livestock and wildlife, as well as a source for recreation, water supply, and energy and mineral resources. A primary objective of range management is to provide the best mix of products, uses, and values demanded by people without reducing future production and possible uses through land deterioration. In the future more of the nation's meat supply is expected to be produced on rangelands. Two areas of research are suggested to conserve soil and water resources on the nation's rangeland: rehabilitation and management of rangeland for efficient use of soil and water resources, and inventory and classification of rangeland for monitoring soil and water resources. To rehabilitate deteriorated rangeland, better and more efficient methods of brush and weed control, revegetation, management of insects, and improved cultural techniques are needed. Grazing systems must be developed that enable livestock to more efficiently use rangeland forage while improving or maintaining soil, water, and vegetation resources. Range plants and animals with greater biological efficiency must be selected and bred. Methods for evaluating the effects of soil erosion and water loss on range productivity are needed. Uniform procedures are required to make inventories of range use, suitability, condition, and trends. Better procedures are also needed to classify range potential. (See also W87-07680) (Geiger-PTT)
W87-07687

CONSERVING WATER: THE UNTAPPED ALTERNATIVE,
Worldwatch Inst., Washington, DC.
For primary bibliographic entry see Field 3C.
W87-07722

SHUTTING OFF THE WATER,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
D. Aksler, S. Adams, and H. Kelley.
Agricultural Research AGREA5, Vol. 34, No. 7, p 6-11, August 1986.

Descriptors: *Water conservation, *Agriculture, *Dry farming, Crop production, Cultivated lands, Soil conservation, Crop yield, Wheat, Sorghum, Cotton.

Changes in the economics of farming (costs versus income) have prompted farmers in the Texas High Plains to take a hard look at the wisdom of irrigating crops. Some farmers have returned to dryland farming. The cost of natural gas used to pump water has risen, and it is necessary to pump water from greater depths as the Ogallala aquifer is depleted. Crop prices have declined. Agricultural researchers are convinced that proper farming techniques to manage soil and water can avoid another Dust Bowl, even during an extended drought. No single discovery makes a profitable return to dryland farming possible. It is a combination of better crops, better farming methods, and better resource management. Specific techniques include: (1) Water conservation and conservation tillage, using methods that retain rainfall, reduce evaporation, and take advantage of the rainfall patterns; (2) terraces and dikes, using bench terraces on gentle slopes to reduce runoff, and furrow dikes across the furrows to trap rainfall; (3) weed control, in reduced tillage or no-till systems, using herbicides to prevent the growth of weeds that compete for scarce water; (4) the 'Sandfighter' implement which roughens the soil surface and minimizes wind erosion; and (5) cropping practices, particularly a 3-year rotation of wheat, sorghum, and fallow that reduces soil erosion while providing crops with adequate water. (McFarlane-PTT)
W87-07819

SOIL AND SUBSOIL MOISTURE ACCUMULATION DUE TO DRYLAND AGRICULTURE IN SOUTHERN ALBERTA,
Department of the Environment, Lethbridge (Alberta). Earth Sciences Div.
For primary bibliographic entry see Field 2G.
W87-07906

COMPUTER-ASSISTED MAPPING OF IRRIGATION WATER REQUIREMENTS FOR VANCOUVER ISLAND BASED ON SOIL AND AGRICULTURAL CAPABILITY SURVEY DATA,
British Columbia Ministry of Environment, Victoria. Water Management Branch.
For primary bibliographic entry see Field 7C.
W87-07916

INFLUENCE OF DRAIN DEPTH ON THE RATE OF SOIL RECLAMATION IN IRRIGATED AREAS OF SOUTHERN ALBERTA,
Department of Agriculture, Lethbridge (Alberta). Drainage Branch.
For primary bibliographic entry see Field 4A.
W87-07917

COMPACTION AND TILLAGE DEPTH COMBINATIONS FOR WATER MANAGEMENT AND RICE PRODUCTION IN LOW-RETENTIVE PERMEABLE SOILS,
Indian Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering.
S. Kar, R. P. Samui, J. Prasad, C. P. Gupta, and T. K. Subramanyam.
Soil and Tillage Research SOTRD5, Vol. 6, No. 3, p 211-222, February 1986. 2 fig, 7 tab, 7 ref.

Descriptors: *Water management, *Tillage effects, *Compacted soils, *Cultivation, *Rice, *Crop yield, *Crop production, *Pervious soils, Percolation, Soil textures, Laterites, Permeability, Soil types, Field tests, Density, Soil density, Puddling, Infiltration.

A tillage scheme was developed from long-term field experiments to reduce percolation losses and enhance the productivity of rice in coarse-textured lateritic soils under lowland and upland conditions. Soil was artificially compacted by one (D1), two (D2), four (D3), or six (D4) passes of an 800-kg iron roller, followed by post-compaction tillage or puddling depths of 0, 5, 10, or 15 cm. Rice yield was significantly increased on upland by two roller passes, but decreased on further compaction. Under post-compaction tillage, grain yield decreased at low compaction level (1 or 2 passes) but increased at higher compaction levels with increase in tillage depth from 0 to 15 cm. Maximum yield occurred at 4 passes and 5 cm puddling depth. Higher yield under treatments of D3 + 5 cm, D2 + 0 cm, D4 + 10 cm was attributed to more favorable soil bulk density profile, lower infiltration rate, and higher surface retention of water. These combinations also apparently increased the efficiency of applied nitrogen fertilizer, since upland rice yield experienced insignificant reduction with decrease in N application rate from 100 to 60 kg/ha. Similar trends of yield response to compaction-tillage combinations were observed under lowland conditions as well. (Doria-PTT)

W87-07921

EFFECTS OF TILLAGE METHODS AND WATER REGIMES ON SOIL PROPERTIES AND YIELD OF LOWLAND RICE FROM A SANDY LOAM SOIL IN SOUTHWEST NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
L. T. Ogunremi, R. Lal, and O. Babalola.
Soil and Tillage Research SOTRD5, Vol. 6, No. 3, p 223-234, February 1986. 6 tab, 30 ref.

Descriptors: *Tillage effects, *Cultivation, *Hydrological regime, *Soil properties, *Crop yield, *Compacted soil, *Rice, *Sand, *Loam, *Nigeria, Soil types, Field tests, Puddling, Soil physical properties, Infiltration rate, Permeability coefficient, Soil water, Water potentials, Soil water potential, Flooding, Nutrients, Calcium, Magnesium, Phosphorus, Sodium, Manganese, Iron, Zinc, Cations, Heavy metals.

Field experiments were conducted on a sandy loam soil to assess the effects of compaction, puddling, and no-till systems on soil physical properties and on rice growth and yield with and without supplementary irrigation. Soil compaction decreased macro- and micropores more than puddling or no-till treatments. The equilibrium infiltration rates were 0.12, 0.15, and 1.65 micron/s in compacted, plowed, and no-till treatments, respectively. The saturated hydraulic conductivity, void ratio, and moisture content at 0.01 and -1.5 MPa water potential followed a similar trend. The mean weight diameters were 2.40, 2.36, and 2.09 mm for compacted, puddled, and no-till treatments, respectively. The mean grain yields for four consecutive crops were 6.4, 5.1, and 4.9 Mg/ha, the compacted being significantly greater than the puddled and no-till treatments. Compared with both puddling and no-till treatments, soil compaction resulted in significant yield increases of about 20% under the rain-fed regime and from 34 to 40% in the flooded moisture regime. There was about 26% increase in rice grain yield by continuous flooding over the rain-fed treatment, with the rice producing greater dry matter and biological yields due to a higher uptake of P, Ca, Mg, K, Na, Mn, Fe, and Zn. (Author's abstract)
W87-07922

WATER EROSION CONTROL,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 4D.
W87-07998

OPTIMAL IRRIGATION MANAGEMENT UNDER POOR DRAINAGE AND SALINE CONDITIONS,
California Univ., Riverside.
For primary bibliographic entry see Field 3C.
W87-08010

EVALUATION OF LOW-FLOW SPRINKLERS,
California Univ., Riverside.
S. E. C. Post, D. E. Peck, R. A. Brendler, N. J. Sakovich, and L. Waddle.
California Agriculture CAGRA3, Vol. 40, No. 7/8, p 27-29, July-August 1986. 2 fig, 3 tab.

Descriptors: *Sprinklers, *Irrigation design, *Irrigation efficiency, Performance evaluation, Computers, Standard deviation, Distribution, Crop production.

Application uniformity was tested for overlapping low-flow sprinklers by using catch cans placed at various distances around the sprinkler head. Tests were conducted on the sensitivity of the geometric arrangement of cans, can numbers, and data analysis. Results show that application uniformity values for nonoverlapping sprinklers are much lower than for overlapping sprinklers, regardless of procedure or geometry of can pattern. The Merriam and Keller distribution uniformity (DU) or distribution characteristic (DC) procedures were found to represent the entire pattern fairly well when based on either a radial leg with 8 cans or a diagonal pattern with 16 cans. The geometric arrangement was of greater significance than the number of cans in estimating uniformity. (Doria-PTT)
W87-08011

CHARACTERIZATION OF PEACH ROOTS IN FOX SAND AS INFLUENCED BY SPRINKLER IRRIGATION AND TREE DENSITY,
Department of Agriculture, Harrow (Ontario). Research Station.
R. E. C. Layne, C. S. Tan, and R. L. Perry.
Journal of the American Society for Horticultural Science JOSHB5, Vol. 111, No. 5, p 670-677, September 1986. 8 fig, 1 tab, 22 ref.

Descriptors: *Peaches, *Irrigation effects, *Sprinkler irrigation, *Density, *Trees, *Irrigation efficiency, *Root distribution, Orchards, Irrigation, Mapping, Roots, Distribution patterns, Crop production, Water requirements, Nutrition, Trickle irrigation.

The trench profile method was used to map peach roots in an 11-year-old experimental orchard at 3 levels of irrigation and 3 tree densities. Location, number, and diameter of roots near the drip line were greatly affected by irrigation and only moderately affected by tree density. The total number of roots was highest in nonirrigated plots and decreased with increasing levels of irrigation. Irrigation promoted shallow rooting near the drip line. Trees receiving the low and high level of irrigation had 35% and 42%, respectively, of their roots in the top 30 cm of soil, compared with only 18% for those in nonirrigated plots. At depths of 30 to 120 cm in nonirrigated plots, 82% of the roots near the drip line were found in these soil layers, compared with 65% for the low and 58% for the high level of irrigation. Tree density had no effect on total root number near the drip line, although there was an increase in root number with an increase in tree density 90 to 120 cm from the trunk on both sides of the tree, and a decrease in root number with an increase in tree density within 60 cm of the trunk. (Author's abstract)
W87-08012

INFLUENCE OF DIFFERENT NITROGEN AND IRRIGATION TREATMENTS ON THE SPECTRAL REFLECTANCE OF BARLEY,
Stockholm Univ. (Sweden). Dept. of Physical Geogrpahy.
For primary bibliographic entry see Field 7B.
W87-08102

ON-FARM WATER MANAGEMENT PROJECT IN PAKISTAN,
Agency for International Development, Washington, DC.
J. E. Painter, E. Baldwin, S. Malone, E. T. Smerdon, and A. S. Ahmed.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-243286. Price codes: A06 in paper copy, A01 in microfiche. A.I.D. Project Impact Evaluation Report No. 35, June 1982. 97 p, 21 ref, 7 append.

Descriptors: *Water management, *Pakistan, *Farm management, Developing countries, Water use, Project planning.

Watercourse improvements conducted under A.I.D.'s On-Farm Water Management Project in Pakistan have enabled farmers to increase their crop yields and incomes. This report analyzes the setting, history, and impact of the project. While water user associations were not effectively established, farmer awareness of the importance of mutual cooperation grew, informal mechanisms have been quite successful in maintaining watercourses, and demand for watercourse improvements has risen. However, the project failed to increase district government awareness of the need for on-farm water management and failed to institutionalize a mechanism through which that need can continue to be met. Moreover, the project design did not address regional differences, baseline data collection and project monitoring were adequate, and the cost of watercourse improvements exceeded original estimates. Planned precision-leveling of fields to improve water use was not as successful as envisioned due to farmer reluctance to participate and the Pakistani Government's decision to de-emphasize leveling. Nor was extension training of farmers adequately implemented, due partly to competition with an existing extension service as well as to A.I.D.'s use of the fixed amount reimbursement mechanism. Project experience also showed that: (1) costs could have been reduced and benefits spread wider if farmers had been asked to contribute, as they were willing to do; (2) flexible project design is needed to adapt to local needs; (3) in a cultural setting where community cooperation is not traditional, formal structures must be built to ensure system maintenance; (4) concentrated land ownership can cause small farmers to realize little increase in water; and (5) more attention should be given to planning extension functions, training implementors and extensionists, collecting baseline data, and developing local governmental commitment. (Author's abstract)
W87-08210

DEVELOPMENT OF SMALL SCALE GASIFIERS FOR IRRIGATION PURPOSE IN INDIA,
V. Damour, and M. S. Damour.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-901350. Price codes: A05 in paper copy, A01 in microfiche. February 18, 1982 - July 7, 1983. (1984). 60 p, 7 fig, 7 append.

Descriptors: *Gasification, *Irrigation practices, *India, *Developing countries, *Gasifiers, Farm management, Economic aspects.

Research on alternate sources of energy for agriculture in India has revealed the high potential of biomass, and created new interest for gasification of biomaterials for motive power. At Jyoti Solar Energy Institute, it was possible to develop a 5 HP wood-based gasifier pumpset prototype running on 80% woodgas and 20% diesel, for irrigation purposes. The complete technical documentation of the development work is given in this report. Development of such gasifier-pumping units will involve a five to seven years program consisting of long run tests of reliability on field implantation units. Special attention will be paid to energy plantations, and on economic feasibility study. (Author's abstract)
W87-08211

DESIGN AND DEVELOPMENT OF A SMALL OUTPUT MULTIBLADE TYPE WINDMILL FOR PUMPING WATER FOR AGRICULTURAL PURPOSES,
Indian Inst. of Tech., Bombay. Dept. of Mechanical Engineering.
B. S. Jagadish, A. Jaganmohan, A. W. Date, and S. P. Sukhatme.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-901349. Price codes: A06 in paper copy, A01 in microfiche. Report No. NP--4901349, December 1983. 95 p, 23 fig, 9 tab, 23 ref, 2 append.

Descriptors: *Windmills, *Pumping, *Irrigation practices, *India, *Bombay, *Design criteria, Agriculture, Rotors, Performance evaluation.

Windmills appear to be promising for water pumping application in the Indian context. The conventional systems may not be the answer if large quantities of water are required to be pumped as in the case of agriculture. The present study is concerned with evolving a design suitable for operation with rotary pumps. Wind data for Santa Cruz, Bombay, is analyzed and designs for two horizontal axis, multiblade type rotors suitable for operation for wind speed in the range of 8 to 30 kmph are evolved. Rotor-1 is designed to develop 250 W at 20 kmph and has a solidity of 0.4; Rotor-2 is designed to develop 200 W at 18 kmph and has a solidity of 0.3. Thus both have solidity ratio considerably less than the conventional design used for similar applications. A rotary pump of the sliding vane pump is used in the system. Though feasible it

is probably not the best choice. Thus there is need for developing a suitably matched pump. The design details and performance of the windmill tested over a period of nearly two years is presented. Also presented are the cost estimates and economics of operation to enable the evaluation of the windmill with alternatives for water pumping applications. (Author's abstract)
W87-08212

TECHNICAL GUIDE TO WATER MANAGEMENT ON SMALL FARMS,
Southwest Research Inst., San Antonio, TX.
H. M. Mason.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-242668. Price codes: A04 in paper copy, A01 in microfiche. 89 p, 12 ref. AID Contract No. AID/4a/-1479.

Descriptors: *Agriculture, *Water management, *Farms, *Irrigation practices, Irrigation efficiency, Water demand, Irrigation, Drainage, Water quality, Water supply.

In recent years, supplemental irrigation systems have been used to boost production in rain-scarce agricultural areeas. This report offers a guide to some technologies developed under A.I.D. auspices to help small farmers maximize the use of scarce water resources. The subject of rainfed agriculture is expresaly stated as beyond the scope of the guide. Individual chapters, illustrated with photographs and drawings, are devoted to: (1) crop water requirements; (2) land grading for water control; (3) irrigation methods; (4) water quality and distribution systems; (7) watercourse management; and (8) irrigation water supply. Efficient irrigation starts by knowing how much water a certain crop will use and how much water should be applied at each irrigation. Unfortunately, the amount of water actually reaching crops is only a fraction of the water originally delivered to a system. The reasons are many: evaporation losses, seepage, poorly designed and maintained ditches and fields, and useless vegetation growing in or along systems. For example, the surface of irrigated fields must be even and flat so that water will be equally distributed. The planting of annual crops the first year in newly graded fields is encouraged. Farmers must also choose methods of irrigation - surface, oversurface, or subsurface - that will: maintain a continuous supply of readily available moisture and a health soil environment for root systems; function properly under given soil and land conditions; and provide a satisfactory net return to the farmer. Three common irrigation problems are salinity, alkalinity, and waterlogging. Water, however pure, contains dissolved salts, and long-term application can result in significant salt accumulation in the soil. The preferred cure is to apply 10% more water than plants need, causing salts to be leached below the root zone. Excess water applications, howver, can cause waterlogging, requiring construction of a drainage network. When measurements of water flow reveal large water losses, intensive rehabilitation must begin. (Author's abstract)
W87-08228

FIELD STUDIES OF IRRIGATION EFFICIENCY IN THE IMPERIAL VALLEY,
California Univ., Riverside.
J. D. Oster, J. L. Meyer, L. Hermsmeier, and M. Kaddah.
Hilgardia, Vol. 54, No. 7, p 1-15, October 1986. 2 fig, 9 tab, 17 ref.

Descriptors: *Irrigation efficiency, *Field tests, *Imperial Valley, *Colorado River, *Irrigation requirements, Drainage, Drainage water, California, Agriculture, Water demand, Leachates, Leaching, Recycling.

Irrigation return flows to the Salton Sea originating from on-farm and conveyance losses are potential water sources that could be used by the Imperial Irrigation District (IID) to increase the irrigated area in the Imperial Valley or by other California users of Colorado River water. An on-farm irrigation study conducted by USDA-ARS and IID between 1977 and 1981 provided estimates of on-farm return flows originating from runoff and drainage, as well as crop water and leaching requirements. Recovery of all runoff water without any change in cropping practices would yield about 0.4 sq km/yr. All but 0.1 sq km/yr of this runoff water would be needed on-farm, if irrigation practices were changed so that crop water and leaching requirements were fully met without recycling drainage water for irrigation. If drainage water were recycled, only 0.1 sq km/yr would be needed, leaving 0.3 sq km/yr which could be used elsewhere. Combining these estimates of recoverable water with those for recoverable conveyance losses from IID operations of 0.3 sq km/yr results in a total which ranges from 0.4 to 0.6 sq km/yr. This brackets the maximum reproduction in Colorado River water available to California after full implementation of the Central Arizona Project. (Author's abstract)
W87-08273

LANDSCAPING ALTERNATIVES AND IRRIGATION CONSERVATION,
Sanford Homes, Inc., Englewood, CO.
N. M. Schmidt.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 53-59, 1 fig, 1 tab.

Descriptors: *Water conservation, *Irrigation practices, *Landscaping, Vegetation, Evapotranspiration, Water use.

For the last 2 years, the home building industry has been the recipient of a voluntary effort on behalf of the plumbing industry to provide water-conserving devices as standard equipment. New homes in Colorado have been receiving low-volume, 3-1/2-gallon toilets; low-volume showerheads; and faucet aerators. This is a dramatic case where volunteerism through private enterprise has moved at a faster pace than any government codes. The trend toward smaller, more dense housing, which has primarily been motivated by issues of affordability, certainly has been a positive factor relative to water conservation. Outside irrigation demands are reduced by this trend toward more density. The historic main reasons for people buying new homes have been the need for moving to a larger home and moving to a nicer neighborhood. Energy has now become the number one subject of concern. Although the current main concern of energy is heating, the subject of water conservation also is included in the broad concern for energy-conserving homes. The Denver Lawn Watering Program was started in 1981 to change the existing patterns of overwatering in the area. The scope of the program for 1981, included a Denver Water Department daily calculation of ET data, including daily information about solar radiation, wind, temperature, and local precipitation, if any. This information will be provided to a major television channel for inclusion in the weather forecast. As to future plans for improving the conservation potential of bluegrass in the Denver area, a consumer kit that could be available for about $18 will be offered. It would include some simple measuring devices to better determine the output of sprinkler systems; the four-color informational brochure describing the various options of lawn quality that might be selected; a probe specially designed for lawns, very much like the watering probe that is now being used for indoor house plants, indicating when to water; and a special watering permit that could go in the homeowner's window, exempting those homeowners from 3-day watering. This kit would give the above information along with the daily ET watering forecast, allowing the homeowner to select the kind of lawn desired and to water only when the lawn needs it. (See also W87-08420) (Lantz-PTT)
W87-08425

WATER CONSERVATION: THE LEAKS IN IMPLEMENTATION,
Environmental Policy Inst., Washington, DC.
J. S. Lyon.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 61-66.

Descriptors: *Water conservation, *Surveys, Implementation, Local governments, State governments, Domestic water, Agriculture, Water costs, Water law, Public policy.

The Environmental Policy Institute (EPI) is developing a model water conservation program for the state and local level. The first step was to find out what already exists. The initial process was to review all of the 50 state water codes for existing water conservation laws. Second all state governments or Departments of Water Resources were surveyed by questionnaire. These agencies provided information on water conservation programs, conservation statutes, proposed water conservation programs, or individual conservation elements. The project is also surveying the state university systems and land grant colleges as well as reviewing successful water conservation programs on the local level. When analyzing the state surveys, minimum criteria were developed tp judge if a state has a water conservation program. To qualify, highly residential states must have: a comprehensive public education program; a residential retrofit distribution program; and a progressive rate structure reform. Highly agricultural or rural states must have: an agricultural conservation program; a groundwater management program; and a public education program. One early assessment that can be made from this survey is that a gap exists between the state water codes and their implementation, between local water conservation and its state counterpart, between proposed plans and their implementation. One of the older and primary reasons for this gap is the variety of definitions attached to water conservation. The consequences also mean enormous cost overruns that the taxpayer and local resident must bear. Politics and political favoritism are additional barriers against conservation implementation. For years, water rate structures have benefited the large consumer at the expense of the small consumer and federal taxpayer. Another factor that hinders implementation is that the public is still largely uneducated about the benefits of water conservation. A final major reason for the lack of conservation implementation is the anticipated start-up and operational costs but in fort, the investment returns on these programs can be enormous. Not including the cost of labor or the cost of retrofit kits, the City of Tucson, Arizona spends approximately $3000 yr. on its water conservation project. They have reduced their peak demand by 1/3. (See also W87-08420) (Lantz-PTT)
W87-08426

REUSE OF WASTEWATERS IN AGRICULTURE BY MEANS OF SPRINKLER IRRIGATION ON A FARMLAND AREA OF 3000 HA - LARGE SCALE EXPERIENCE IN GERMANY,
Technische Univ., Brunswick (Germany, F.R.). Inst. fuer Standbauwesen.
For primary bibliographic entry see Field 3C.
W87-08555

USE OF WATER IN ADRIATIC COASTAL TOURIST SITES,
Zagreb Univ. (Yugoslavia). Faculty of Civil Engineering.
For primary bibliographic entry see Field 3C.
W87-08556

TERMINOLOGY FOR DESCRIBING IRRIGATION CONVEYANCE SYSTEMS,
Calgary Univ. (Alberta). Dept. of Civil Engineering.
D. H. Manz.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 142-154, May 1987. 6 fig, 4 ref, append.

Descriptors: *Classification, *Irrigation systems, *Irrigation water conveyance, *Water conveyance, Irrigation requirements, Irrigation, Water demand, Design.

A terminology for describing irrigation conveyance systems is modeled after one introduced by the International Commission on Irrigation and Drainage (1978), and Bos (1979) and (1985); however, this work was significantly modified to provide a greater degree of comprehensiveness and to remove ambiguity. The terminology presented is based on a classification of irrigation conveyance subsystems identified by their relationship to the irrigation water demands they are intended to satisfy. The terminology ignores the management/ownership characteristics of conveyance systems and their relationship to water supply. These conveyance system attributes, as well as methods with which to identify and provide names for different segments of irrigation conveyance systems, are discussed in terms of the additional descriptive information function they provide. The terminology developed permits a concise relevant discussion of irrigation conveyance system design and operations. (Author's abstract)
W87-08579

SIMPLIFIED IRRIGATION SCHEDULING AND CROP SELECTION FOR EL SALVADOR,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
G. H. Hargreaves, and Z. A. Samani.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 224-232, May 1987. 1 fig, 3 tab, 13 ref.

Descriptors: *Irrigation scheduling, *Crop selection, *El Salvador, *Crop water use, Temperature, Irrigation, Agriculture, Farming.

A unique condition exists for the country of El Salvador: By knowing only the elevation, the type of crop suitable for the area and the crop water requirement can be evaluated. This paper shows how elevation can be used to estimate the maximum and minimum temperatures for crop selection and for estimating crop water requirements. The need of simple, reliable, and easy-to-use methods for scheduling irrigation is emphasized. Few irrigators are literate and only a very small percentage have received training and/or instruction relative to the amount and frequency of irrigation. Approval of a $25,200,000 water management project to promote the production of high value, labor-intensive crops gives emphasis to the needs for improved extension programs and for farmer training in irrigation scheduling. (Author's abstract)
W87-08586

FURROW IRRIGATION USING CANAL SIDE WEIRS,
Arizona Univ., Tuscon. Dept. of Agricultural Engineering.
S. Eftekharzadeh, A. J. Clemmens, and D. D. Fangmeier.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 251-265, May 1987. 4 fig, 1 tab, 27 ref. Water Conservation Lab Cooperative agreement 58-9AHZ-9-436.

Descriptors: *Weirs, *Furrow irrigation, *Canals, *Model studies, *Flow, Velocity, Design criteria, Irrigation.

The potential of canal side weirs for uniform water delivery to irrigation furrows and system flexibility is assessed. Weir discharge uniformity is affected by: (1) Canal velocity and weir entrance conditions; (2) variations in weir crest construction elevations; and (3) variations in water surface elevations along the distribution canal. For sharp-entranced weirs, model studies show that the decrease in canal flow velocity down a typical distribution reach can result in an increase in weir discharge up to 15%. This velocity effect is significantly dampened by using a streamlined entrance to the weir. Field data on weir crest elevations have a standard deviation of about 3 mm, which translates into 6-8% weir discharge variation at normal discharge settings. A computer model of distribution canal flows indicates weir discharge uniformity is improved by shortening the length of the reach, reducing the required weir discharge setting, and increasing canal size. A design guideline is developed for the system. (Author's abstract)
W87-08588

1-D, 2-D, AND 3-D INFILTRATION FOR IRRIGATION,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
V. P. Singh, Y.-C. He, and F.-X. Yu.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 266-278, May 1987. 6 fig, 4 tab, 12 ref, append.

Descriptors: *Model studies, *Infiltration, *Irrigation, Darcys law, Energy, Equations, Performance evaluation, Model testing, Calibrations.

Models for one-, two-, and three-dimensional infiltration for irrigation are derived using an energy equation and Darcy's law. The models were verified with Fok and Chiang's experimental data. A good agreement is found between the model-computed and observed values of infiltration. Average relative error of cumulative infiltration values is less than 5%. (Author's abstract)
W87-08589

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PAB (PARABOLIC AND BACKWATER) AN UNCONDITIONALLY STABLE FLOOD ROUTING SCHEME PARTICULARLY SUITED FOR REAL TIME FORECASTING AND CONTROL,
Bologna Univ. (Italy).
For primary bibliographic entry see Field 2E.
W87-07866

INFLUENCE OF DRAIN DEPTH ON THE RATE OF SOIL RECLAMATION IN IRRIGATED AREAS OF SOUTHERN ALBERTA,
Department of Agriculture, Lethbridge (Alberta). Drainage Branch.
G. D. Buckland, D. B. Harker, and T. G. Sommerfeldt.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 3, p 531-535, August 1986. 2 fig, 1 tab, 10 ref.

Descriptors: *Drainage effects, *Soil management, *Cropland, *Alberta, *Subsurface drainage, *Solute transport, *Saline soils, Drainage, Leaching, Soil types, Salinity, Drains, Drought, Salts, Sodium, Accumulation.

Leaching trials were conducted for two years on two irrigated saline-sodic soils with subsurface drains installed at depths of 0.76, 1.22, and 1.68 m. At one site, after two years of leaching, average salinity levels in the 0- to 2.0-m soil depth were reduced to 91, 88, and 74% of original levels with drain depths of 0.76, 1.22, and 1.68 m, respectively. At the other site, where less water was applied, respective salinity levels were 114, 86, and 99% of original levels. Resalinization and resodification of the surface 0.2 m of soil occurred at both sites in the second year, which was a drought year, and were most pronounced with a drain depth of 0.76 m. Relative reductions in salinity, and efficiency of leaching, were lowest for the 0.76-m-depth drains at both sites. (Author's abstract)
W87-07917

EFFECTIVENESS OF BLUE TILAPIA AS A WEED CONTROL AGENT IN PONDS,
Langston Univ., OK.
D. P. Schwartz, O. E. Maughan, and G. E. Gebhart.
The Progressive Fish Culturist PFCUAY, Vol. 48, No. 4, p 259-263, October 1986. 5 fig, 2 tab, 12 ref.

Descriptors: *Tilapia, *Limnology, *Ponds, *Blue tilapia, *Aquatic weed control, Submerged plants, Najas, Chara, Aquatic weeds, Temperature, Dissolved oxygen.

Blue tilapia (Tilapia aurea) stocked at densities of 500 to 2,500 adults/hectare, plus their offspring, successfully controlled submersed vegetation dominated by Najas and Chara. Vegetation control resulted in higher and more uniform water temperatures and dissolved oxygen concentrations than occurred in control ponds. (Author's abstract)
W87-08113

PARTIAL DURATION SERIES MODELING UNDER THE ASSUMPTION OF A POISSONIAN FLOOD COUNT,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 2E.
W87-08124

CONTROL OF SURFACE RUNOFF BY SUBSURFACE INFILTRATION OF STORMWATER: A CASE STUDY IN JAPAN,
Ministry of Construction, Tokyo (Japan). River Bureau.
For primary bibliographic entry see Field 4B.
W87-08156

RESERVOIR OPERATION (LA GESTION DES BARRAGES RESERVOIRS),
Electricite de France, Chatou.
J. Miquel, and P. A. Roche.
La Houille Blanche, No. 6, p 409-425, 1986. 17 fig, append.

Descriptors: *Reservoir operation, *Optimization, Management planning, Decision making, Dams, Operating policies.

On the 5th of June 1984, a working party of the Societe hydrotechnique de France (French Hydrotechnic Company) met to discuss the current orientations and achievements in the field of reservoir operation: formulation of objectives, studies of related operations, calculation methods, and also the questions, regarding dimensioning of works, posed by the varying uncertainties. The first part of the article describes the methods tested in France and compares them with some references in other countries. In the second part, which is more prospective, some research orientations not yet being used operationally are described. (Author's abstract)
W87-08277

COMPUTERIZED MANAGEMENT OF FLUVIAL PLANTS WITH MULTIPLE AIMS: THE RHONE EXAMPLE (LA GESTION AUTOMATISEE D'AMENAGEMENTS FLUVIAUX A BUTS MULTIPLES: L'EXEMPLE DU RHONE),
Compagnie Nationale du Rhone, Lyon (France).
N. Bordiec, and A. Frezet.
La Houille Blanche, No. 6, p 427-439, 1986. 15 fig.

Descriptors: *Automation, *Dams, *Computers, *Facility operation, *Rhone River, Flood control, Mathematical models, Multiobjective planning, Hydroelectric power production.

Hydraulic plants with multiple aims (power generation, large scale merchant service, protection against floods) pose to their operating companies various types of problems linked to the types of exploitation and management envisaged for them. In the case of the Rhone (18 plants in series over 530 km), the number and the diversity of the constraints, such as developments involving waterfalls, floods, various forms of water use, have led the Compagnie Nationale du Rhone (CNR) to adopt automatic control using computers as described in the article. (Author's abstract)
W87-08278

PERIODIC OPTIMAL CONTROL WITH APPLICATION TO PUMPED STORAGE PLANTS,
Israel Electric Corp. Ltd., Haifa.
For primary bibliographic entry see Field 8C.
W87-08329

PLOTTING POSITIONS FOR HISTORICAL FLOODS AND THEIR PRECISION,

Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2E.
W87-08349

ROLE OF LAND USE PLANNING IN WATER CONSERVATION,
American Planning Association, Chicago, IL.
For primary bibliographic entry see Field 3D.
W87-08430

SCOTTISH BURN,
Dundee Coll. of Technology (Scotland). Dept. of Civil Engineering.
C. Jeffries, G. S. W. Stevens, and R. M. Ashley.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 6, p 483-500, December 1986. 8 fig, 4 tab, 10 ref.

Descriptors: *Flood control, *Flow forecasting, *Model studies, *Ownership of beds, *Legal aspects, Urbanization, Watercourses, Riparian water, Computer programs, Flood peak, Scotland.

The Lyne Burn is a small watercourse which drains a heavily urbanized part of the South Fife coalfield. The watercourse suffers in many places from dereliction and neglect. A hydrological and hydraulic study was carried out to develop a simple management model for the catchment. Flow prediction for the burn has been facilitated by the development of a suite of microcomputer programs based on the Flood Studies Report and other techniques. The adjustment of the model following a data collection program (3 years of data) and the application to specific locations is discussed. The study of this heavily urbanized catchment has highlighted the inadequacies of the law pertaining to watercourses in Scotland. There is no satisfactory control over developers who wish to construct culverts or alter the course of the burn, nor is there proper responsibility for maintaining the watercourse free from blockages. This inadequacy of the law is likely to contribute to both flooding and pollution in the future. (Airone-PTT)
W87-08530

4B. Groundwater Management

TESTING OF LATERAL WATER FLOW IN A MOISTURE BARRIER,
Los Alamos National Lab., NM.
W. V. Abeele, and G. L. DePoorter.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84-015158. Price codes A02 in paper copy and A01 in microfiche. Los Alamos Report No. LA-10125-MS,June 1984. 4 p. 2 fig, 1 ref.

Descriptors: *Flow discharge, *Lateral flow, *Moisture barriers, *Flow patterns, Particle size, Model studies, Capillarity, Infiltration.

Small-scale modeling has demonstrated that capillary barriers can protect dry structures in porous media. Barriers are created by differences in particle size and are effective because suction predominates over gravity forces. The percolating liquid will penetrate the coarser material only after the overlying finer material nears saturation. Consequently, the structure, which is enclosed in the coarser material, remains dry. As long as the pressure at the coarse'fine interface remains negative, water infiltrating the finer layer will not cross the interface; instead, it will flow laterally until percolation recurs where water reaches the edge of the coarser layer. The limiting granulometric differences beyond which this phenomenon ceases to exist have been determined. This barrier concept has sometimes been referred to as the 'wick effect'. This study has found that, under unsaturated conditions, a gravel lens caused lateral flow in a finer textured overlying material. The water will travel only a limited distance laterally and is influenced by the slope of the interface. (Lantz-PTT)
W87-07678

GEOHYDROLOGY OF THE DAKOTA AQUIFER.
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 2F.
W87-07755

OPTIMAL SITING OF ARTIFICIAL RECHARGE: AN ANALYSIS OF OBJECTIVE FUNCTIONS,
Wuhan Coll. of Geology, Beijing (China). Hydrogeology Research Group.
C. Li, J. M. Bahr, E. G. Reichard, J. J. Butler, and I. Remson.
Ground Water GRWAAP, Vol. 25, No. 2, p 141-150, March-April 1987. 7 fig, 4 tab, 7 ref, 3 append.

Descriptors: *Artificial recharge, *Groundwater management, *Groundwater, *Imported water, *Model studies, *Drawdown, San Juan Valley, California, Water management, Recharge, Mathematical models, Mathematical studies, Simulation analysis, Simulation, Nonlinear programming, Linear programming, Computer programming, Water allocation, Economic aspects, Mathematical equations, Costs.

A simulation model was used in conjunction with linear and nonlinear programming to examine the effects of various management choices on the optimal allocation of imported water for artificial groundwater recharge in the San Juan Valley of Central California. The simple linear objective of minimizing the sum of the absolute values of drawdowns was of little value due to its dependence on hydrogeologic properties. The choice between more complex linear and nonlinear objectives is shown to depend on the economic impacts one wishes to emphasize. Suitability of different drawdown reference levels was found to be a function of the specific form of the objective. Sensitivity analysis showed that the imported water could be recharged anywhere in the central portions of the cone of depression with minimal effect on the value of the objective function. Parametric variation of the total recharge rate illustrated the dependence of the various functions on the distribution of drawdown discharge rates, and hydrogeologic properties. A preliminary analysis allowed the importance of conveyance cost to be demonstrated. It was demonstrated that decisions regarding objective functions and their reference levels can be made only after careful consideration of basin characteristics and management goals. (Author's abstract)
W87-07848

COMPUTER MODEL FOR SIMULATING WATER QUALITY AND QUANTITY IN A WELLFIELD IN AN ALLUVIAL AQUIFER,
Nebraska Univ.-Lincoln. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-07849

MICROCOMPUTER PROGRAM FOR INTERPRETING TIME-LAG PERMEABILITY TESTS,
SRW Associates, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 7C.
W87-07856

RESULTS OF BUILDING A 12-INCH DIAMETER PRODUCTION WELL IN GRANITE,
Caswell, Eichler and Hill, Inc., West Topsham, VT.
B. Caswell.
Water Well Journal WWJOA9, Vol. 41, No. 3, p 38-40, March 1987. 4 fig, 1 tab.

Descriptors: *Groundwater management, *Wells, *Water supply development, *Groundwater, *Granites, *Large-diameter wells, Water management, Aquifers, Crystalline rocks, Comparison studies, Well capacity, Well data, Drawdown, Hydraulic properties, Pumping tests, Pumping.

The groundwater supply for an industrial facility in the Northeast was developed starting with 6-inch diameter exploration test wells and proceeding with evaluation of an 8-inch diameter test well constructed at the most favorable exploration site. Finally, a 12-inch diameter production well was constructed at the same site in the granite pluton. Comparisons were made between the specific capacity, well efficiency and yields of the 8-inch and 12-inch wells. Aquifer drawdown and recovery were also compared for the two wells. It was concluded that construction of the 12-inch production well in the granite aquifer resulted in a significant improvement in well performance, but did not cause significant changes in the hydraulic characteristics of the aquifer. The same results are expected when drilling in a crystalline bedrock aquifer as in unconsolidated sand or gravel aquifers. The main reason for recommending construction of a larger diameter well in this case was to provide the industrial user with an efficient well that will, because of the shallower pumping depths needed, result in lower power consumption in the long run. The larger diameter will also decrease the likelihood of dewatering the deep water-bearing zones. (Wood-PTT)
W87-07859

HONDA RUNS ON GROUND WATER,
S. Hurlburt.
Water Well Journal WWJOA9, Vol. 41, No. 3, p 47-50, March 1987.

Descriptors: *Groundwater management, *Wells, *Water use, *Groundwater, Marysville, Ohio, Drawdown, Groundwater level, Water level, Groundwater availability.

The Honda manufacturing facility in Marysville, Ohio, relies on four wells to supply an average of 528,000 gallons of water per day. The original 8-inch diameter well was first drilled as an exploratory well but was retained as a reserve well for backwashing, while Honda alternates monthly among the other three 16-inch diameter wells to satisfy its water needs. Honda was accused by local residents of causing problems in the efficiency of their private wells. A second survey substantiated the initial findings which indicated that Honda could use twice as much water before affecting the water table; at a one mile radius drawdown was approximately one foot, and at one and a half miles it was approximately six inches. However, Honda redrilled wells or replaced pumps at the company's expense even when other problems were shown to be the cause of the homeowners' complaints. (Wood-PTT)
W87-07860

ARTIFICIAL RECHARGE OF GROUNDWATER.
California State Water Resources Control Board, Sacramento.
Butterworth Publishers, Boston, Massachusetts. 1985. 767 p. Edited by Takashi Asano.

Descriptors: *Artificial recharge, *Groundwater recharge, Wastewater renovation, *Water reuse, Pretreatment of water, Soil contamination, Legal aspects, Economic aspects.

To introduce the wide range of technical issues related to artifcial recharge of groundwater, this book opens with an overview chapter that summarizes the state of the art of artificial recharge of groundwater and presents a synopsis of the chapters that follow. In addition, Part I presents the fundamental aspects of groundwater recharge, including the role of artificial recharge in groundwater basin management, recharge methods, hydraulics, monitoring, and modeling. In choosing among the several sources of available water for groundwater recharge, increasing importance has been in recent years on the use of reclaimed municipal wastewater. A number of factors affect the implementation of groundwater recharge with reclaimed wastewater. Historically, the motivation for wastewater reuse has come from three fundamental considerations: (1) availability of high-quality effluent, (2) increasing cost of freshwater development, and (3) desirability of establishing comprehensive water resources planning, including water conservation and wastewater reuse. Pretreatment processes for wastewater and renovation of wastewater with rapid-infiltration land treatment systems are discussed in Part II of the book. Health

effects of wastewater reuse in groundwater recharge are also outlined in this section. A number of artificial recharge operations using reclaimed wastewater are the subject of Part III. The need for definitive information on the extent of contaminant removal by the soil system and on the fate of micropollutants during groundwater recharge has been recognized and is being studied extensively. Part IV of the book specifically deals with these issues. Part V of the book evaluates these legal and economic aspects of groundwater recharge. Research needs for groundwater quality management are also discussed. (See also W87-08138 thru W87-08163) (Lantz-PTT)
W87-08137

ARTIFICIAL RECHARGE OF GROUNDWATER,
California State Water Resources Control Board, Sacramento.
T. Asano.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 3-19, 23 ref.

Descriptors: *Artificial recharge, *Groundwater recharge, Groundwater quality, Model studies, Legal aspects, Pretreatment of water, Wastewater renovation, Research needs.

Natural replenishment of the vast supply of underground water occurs very slowly therefore, excessive continued exploitation of groundwater at a rate greater than this replenishment causes declining groundwater levels in the long term and, if not corrected, leads to eventual mining of groundwater. To increase the natural supply of groundwater, artificial recharge of groundwater basins is becoming increasingly important in groundwater management and particularly in situations where the conjunctive use of surface water and groundwater resources is considered. Artificial recharge may be viewed as an augmentation of the natural movement of surface water into underground formations by some method of construction, by surface spreading of water, or by artificially changing natural conditions. Recharge methods, groundwater sampling and monitoring, modeling of groundwater response to artificial recharge, groundwater recharge with reclaimed wastewater, pretreatment processes for groundwater recharge, health aspects of groundwater recharge with reclaimed wastewater, legal and eocnomic aspects of groundwater recharge, and research needs for groundwater quality management are all briefly discussed. (See also W87-08137) (Lantz-PTT)
W87-08138

ROLE OF ARTIFICIAL RECHARGE IN GROUNDWATER BASIN MANAGEMENT,
California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 21-33, 8 fig, 2 tab, 6 ref.

Descriptors: *Artificial recharge, *Groundwater management, *Groundwater recharge, Aquifers, Aquifer management, Infiltration, Management planning.

Introduced is the importance of groundwater, its place in the hydrologic system, and how artificial recharge fits into groundwater management. Groundwater has special characteristics that distinguish it from other sources of water and dictate how it should be managed. The management principles for an aquifer are similar to those for a surface water reservoir. A surface reservoir is inherently limited by the stream inflow whereas a groundwater reservoir's 'inflow' can be increased by artificial recharge. Designing and managing artifical recharge facilities offer challenging opportunities for the optimal use of aquifers. These tasks, along with other considerations, make artificial recharge a pivotal element in any groundwater management program. (See also W87-08137) (Lantz-PTT)
W87-08139

CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W87-08140

ARTIFICIAL RECHARGE: METHODS, HYDRAULICS, AND MONITORING,
Geological Survey, Syosset, NY. Water Resources Div.
E. T. Oaksford.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 69-127, 28 fig, 102 ref.

Descriptors: *Artificial recharge, *Groundwater recharge, *Monitoring, *Hydraulics, Groundwater quality, Furrows, Ditches, Channel improvement, Streamflow, Irrigation, Groundwater management.

A variety of methods have been developed to recharge groundwater, and most use variations or combinations of direct-surface, direct-subsurface, or indirect recharge techniques. Flooding, ditch and furrow systems, basins, stream channel modifications, streamflow augmentation, overirrigation, pits and shafts, reverse drainage, and wells are just some of the techniques of artificial recharge discussed. The considerations involved in recharge method choice and operation characteristics have been discussed to present the fundamentals of groundwater recharge. Basic groundwater modeling techniques have been presented to provide available alternatives in predicting the effects of aquifer recharge. Water quality and water level monitoring philosophies have also been included to emphasize the necessity of protecting and conserving our groundwater reservoirs. In developing areas as well as in developed countries, urban concentration and industrialization place tremendous demands on water use. Future water use demands will only increase, providing the driving force to implement, on a routine basis, the various artificial recharge technologies. (See also W87-08137) (Lantz-PTT)
W87-08141

MODELING OF GROUNDWATER RESPONSE TO ARTIFICIAL RECHARGE,
California Univ., Irvine. Dept. of Civil Engineering.
G. L. Guymon, and T. V. Hromadka.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 129-149, 8 fig, 16 ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Model studies, *Mathematical models, *Computer models, Groundwater management, Groundwater quality, Groundwater movement, Geohydrology.

Introduced are numerical modeling techniques that can be applied to the hydraulic analysis of artificial recharge of groundwater. Numerical modeling techniques applied to mathematical models of groundwater recharge imply the use of modern digital computers, which are now widely used for many engineering and scientific applications. Improvement in numerical techniques and computers now make it possible to solve rather complicated porous media flow problems on miniclass or even microclass computers. Obtaining and applying a model already developed is sometimes difficult for several reasons. The most often encountered difficulty is that after a model is developed, verified, and applied there are inadequate resources for maintaining the model and servicing it. All modern software that is widely used requires a central enterprise for maintaining the software, usually the vendor. Second, numerical groundwater models, although elegantly constructed to solve the problem they are designed for, are oftentimes not truly user-oriented. Finally, another troublesome problem that may arise in adapting a model to a new environment is that sometimes models may be machine dependent. It is sometimes an unsurmountable task to adapt a model to a different computer from the one it was developed on. As a consequence, it may be more practical in some cases to start from scratch and build a new numerical model. Notwithstanding these problems, numerical modeling, when combined with appropriate geotechnical exploration and hydrologic analyses, is a powerful tool. The use of existing numerical models or the development of a new model require some understanding of not only the physical and chemical processes involved in artificial recharge and groundwater movement but also of the basic mathematical principles needed to develop a numerical analog. (See also W87-08137) (Lantz-PTT)
W87-08142

GROUNDWATER SAMPLING DURING ARTIFICIAL RECHARGE: EQUIPMENT, TECHNIQUES, AND DATA ANALYSES,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7A.
W87-08143

PRETREATMENT PROCESSES FOR GROUNDWATER RECHARGE,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 5D.
W87-08144

RENOVATION OF WASTEWATER WITH RAPID-INFILTRATION LAND TREATMENT SYSTEMS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 5D.
W87-08145

HEALTH ASPECTS OF GROUNDWATER RECHARGE,
Los Angeles County Sanitation Districts, Whittier, CA.
M. H. Nellor, R. B. Baird, and J. R. Smyth.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 329-356, 5 fig, 5 tab, 32 ref.

Descriptors: *Water reuse, *Artificial recharge, *Public health, *Groundwater recharge, *Whittier Narrows, *California, Groundwater quality, Monitoring, Percolation.

Extensive evaluation of the Whittier Narrows, California, groundwater replenishment project did not demonstrate any measurable adverse impacts on the area's groundwater or the health of the population ingesting this water. While the information provided in this chapter delineates the impact of the existing operation of the Whittier Narrows project, it does not directly show what impact the increased use of reclaimed water will have on the quality of the groundwater or the health of the individuals consuming the groundwater. It does, however, serve as a baseline study by which impacts of an expansion of the use of reclaimed water can be evaluated. There is a need for continued monitoring and evaluation of the Whittier Narrows project with respect to the trace organic content of the groundwater and replenishment waters. In addition, investigation of the organic compounds responsible for the mutagenicity detected in bacterial tests may be prudent in order to determine whether or not any connection can be made to human health. Percolation cannot, in itself, be relied upon as a treatment process for the removal of specific health-significant compounds. Given the numerous variables involved with groundwater replenishment, implementation of new projects or expansion of existing projects should be evaluated on a case-by-case basis. Results from this study provided a basis for assessing the relative impacts on groundwater from the various Whittier Narrows percolation sources and for determining the chemical nature of some unknown materials. (See also W87-08137) (Lantz-PTT)
W87-08148

GROUNDWATER RECHARGE OPERATIONS AT WATER FACTORY 21, ORANGE COUNTY, CALIFORNIA,
Orange County Water District, Fountain Valley,

CA.
For primary bibliographic entry see Field 6C.
W87-08149

OPERATIONS AT THE CEDAR CREEK WASTEWATER RECLAMATION-RECHARGE FACILITIES, NASSAU COUNTY, NEW YORK,
Nassau County Dept. of Public Works, Mineola, NY.
For primary bibliographic entry see Field 5D.
W87-08150

PROPOSED GROUNDWATER RECHARGE AT EL PASO, TEXAS,
Parkhill, Smith and Cooper, Inc., El Paso, TX.
D. B. Knorr, and T. Cliett.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 425-480, 22 fig, 12 tab, 10 ref.

Descriptors: *Artificial recharge, *Groundwater recharge, *El Paso, *Texas, Arid climates, Groundwater management, Water supply, Economic aspects, Injection wells.

El Paso, Texas, is located in an arid area with a water supply problem. The problem is of a long-range nature since current mining of underground reserves is meeting present demands. In order to reduce the mining and to provide a secure water supply over the long term, the community is looking at many water sources. The recharge project presented in this chapter is but one of many additional sources that will be required in the future. El Paso's recharge project is a 10 mgd (38,000 cu m/day) direct-injection type system and is currently in the start-up phase. Discussed are the recharge project development costs, pilot work, treatment process, injection wells, and proposed operating procedures. (See also W87-08137) (Lantz-PTT)
W87-08151

GROUNDWATER RECHARGE FOR WASTEWATER REUSE IN THE DAN REGION PROJECT: SUMMARY OF FIVE-YEAR EXPERIENCE, 1977-1981,
TAHAL-Water Planning for Israel Ltd., Tel-Aviv.
E. Idelovitch, and M. Michail.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 481-507, 10 fig, 6 tab, 10 ref.

Descriptors: *Water reuse, *Groundwater recharge, *Wastewater renovation, *Dan Region Project, *Artificial recharge, *Israel, Wastewater treatment, Groundwater management, Aquifers, Air stripping.

The first stage of the Dan Region Sewage Reclamation Project consists of facilities for treatment and groundwater recharge of municipal wastewater discharged from the southern suburbs of the city of Tel Aviv-Jaffa and the neighboring municipalities of Holon, Bat Yam, and Rishon-Le-Zion, with a total connected population estimated at about 400,000. The wastewater pumped to the treatment plant undergoes biological treatment in two parallel series of facultative oxidation ponds with effluent recirculation and chemical treatment by the high lime - magnesium process, followed by detention of the high pH effluent in polishing ponds, mainly for free ammonia stripping and natural recarbonation. The treated effluent has been recharged to the regional groundwater aquifer since 1977 by means of spreading basins, located in the vicinity of the treatment plant. Most of the recharged effluent, after additional treatment and prolonged detention in the soil-aquifer system, will be pumped by means of recovery wells for reuse in the south of the country. In the final stage of the project, when the recovery wells will pump mostly recharged effluent, the reclaimed water will be supplied to nonpotable uses (mainly unrestricted irrigation of agricultural crops), by means of a dual system conveying separately potable and nonpotable water. At present most of the existing recovery wells pump native groundwater to the potable supply network; only a limited number of wells may pump an admixture of native groundwater and small amounts of recharged effluent. (See also W87-08137) (Lantz-PTT)
W87-08152

ROLE OF GROUNDWATER RECHARGE IN THE WATER RESOURCE MANAGEMENT IN POLAND,
Wroclaw Technical Univ. (Poland). Dept. of Sanitary Engineering.
E. S. Kempa, and J. Cebula.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 541-564, 8 fig, 6 tab, 8 ref.

Descriptors: *Groundwater recharge, *Groundwater management, *Poland, *Vistula River, Precipitation, Water supply development, Groundwater supply, Water management.

Most of the land in Poland consists of plains. The average height above sea level for the whole area is only 173 m; the highest peak is Rysy at 2,499 m, and the lowest is the cultivated lowlands in the delta of the Vistula River, which lie 1.8 m below sea level. Most of Poland's land areas, however, lie at the elevations of 0 to 300 m (91.3%) and 75.1% of the land areas are in 0 to 200 m elevation. The quantity of precipitation on the European continent gradually decreases as one moves eastward from the Atlantic. Because of Poland's location, it can be said that Poland is under adverse hydrologic conditions compared with other European countries. Apart from low annual precipitation of 602 mm in the eastern part of Poland, there is a strip of land in central Poland considerably high in evaporation and low in precipitation. Thus, the annual runoff in the central parts of Poland is in the same order of magnitude as in the steppes of the Ukraine, the Great Hungarian plain, and the central course of the Elbe River. The capacity of all lakes located in Poland is estimated to be 33 cu km, whereas more than 80 manmade reservoirs exist that store as little as 2 cu km of water. Of great importance for water supply are the resources of the rivers because they cover 92% of industrial consumption and about 50% of human consumption. Jointly, river waters satisfy approximately 85% of household demands in Poland. Pursuant to the Polish Water Act of 1974, all waters in Poland belong to the state, but the public has a right to these waters. However, the annual consumption of more than 40,000 cu m of surface water and/or 10,000 cu m of groundwater is considered to be a specific utilization of waters, and thus, a legal permit for withdrawal is required from an appropriate water authority. (See also W87-08137) (Lantz-PTT)
W87-08155

CONTROL OF SURFACE RUNOFF BY SUBSURFACE INFILTRATION OF STORMWATER: A CASE STUDY IN JAPAN,
Ministry of Construction, Tokyo (Japan). River Bureau.
K. Ishizaki.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 565-575, 8 fig, 4 tab.

Descriptors: *Artificial recharge, *Surface runoff, *Infiltration, *Groundwater recharge, *Japan, *Case studies, *Artificial recharge, Groundwater management, Groundwater quality, Storm water.

Even though the annual rainfall in Japan is about 1,800 mm, which is twice as much as the average rainfall worldwide, water shortages often occur during the summer months. This is because a large amount of surface water is diverted to flood rice fields and, as a result, river flow is reduced to the minimum. There have been various long-term national programs for the development and management of water resources. Groundwater provides approximately 16% of the water resources requirements in Japan. In some areas, however, the groundwater levels have been lowered by excessive pumping and such problems as land subsidence and seawater intrusion have occurred. There have been many cases, particularly in the coastal regions, where salinity of groundwater has become too high for any significant beneficial uses. In addition, due to the urbanization of river drainage basins in many parts of Japan, the decrease of soil infiltration has caused excessive surface runoff, leading to several serious flooding incidences in the surrounding areas. To reduce excesive runoff and to promote groundwater recharge of stormwater, a number of groundwater recharge methods have been investigated at the Japan Ministry of Construction's Public Works Research Institute. This paper describes the subsurface infiltration of stormwater through culverts and also discusses the effects of the stormwater infiltration experiment at an apartment complex in Tokyo, Japan. (See also W87-08137) (Lantz-PTT)
W87-08156

MICROPOLLUTANT REMOVAL IN RAPID INFILTRATION,
Nolte (George S.) and Associates, Sacramento, CA.
For primary bibliographic entry see Field 5D.
W87-08157

SOIL DEPOSITION OF TRACE METALS DURING GROUNDWATER RECHARGE USING SURFACE SPREADING,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2F.
W87-08158

GROUNDWATER RECHARGE WITH RECLAIMED WASTEWATER: LEGAL QUESTIONS IN CALIFORNIA,
Downey, Brand, Seymour and Rohwer, Sacramento, CA.
A. J. Schneider.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 683-702, 22 ref.

Descriptors: *Groundwater recharge, *Legal aspects, *California, *Groundwater management, *Water reuse, *Artificial recharge, Wastewater renovation.

Uncertainty as to ownership of reclaimed wastewater and potential liability for problems caused by recharge of groundwater basins with reclaimed wastewater could impede future reclaimed wastewater recharge projects in California. In recent years, these uncertainties have offset to some extent strong state and local project support. Concern about potential liability has not yet been allayed by the experiences of several major recharge programs that have been successfully using reclaimed wastewater for groundwater recharge for over 20 years. California's Water Reclamation Law declares that the people of the state have 'a primary interest' in developing wastewater reclamation facilities to supplement existing surface and groundwater supplies. California's experience with groundwater management, conjunctive use of surface water and groundwater, and artificial recharge of groundwater basins both with freshwater and reclaimed wastewater is extensive. But even wide support of wastewater reuse and the existence of sophisticated groundwater management programs have not yet produced a favorable climate for undertaking new reclaimed wastewater recharge projects. With its recent history of efforts to start new groundwater recharge projects using reclaimed wastewater, California's experience offers a cauldron of legal and institutional issues. This chapter evaluates the legal issues in California involved in groundwater recharge programs. Many issues are common to both recharge with freshwater and recharge with reclaimed water. Four main areas will be considered: water rights; control and management of groundwater basin storage; water quality issues and permit requirement; and liability questions. (See also W87-08137) (Lantz-PTT)
W87-08161

ECONOMIC ASPECTS OF GROUNDWATER RECHARGE,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. J. Vaux.
IN: Artificial Recharge of Groundwater, Butter-

worth Publishers, Boston, Massachusetts. 1985. p 703-718, 3 tab, 18 ref.

Descriptors: *Artificial recharge, *Economic aspects, *Groundwater recharge, Legislation, Regulations, Wastewater treatment, Cost analysis, Wastewater renovation.

Prior to the enactment of the 1977 Amendments, federal water quality policies were strongly biased in favor of capital intensive treatment processes. The cost sharing provisions of the 1972 Amendments provided strong incentives to municipalities to construct wastewater treatment facilities even in many situations in which land treatment was feasible and more economical. The 1977 Amendments have partially removed this bias with the result that land treatment of wastewater may become more widespread. Under the appropriate circumstances, land treatment may yield benefits in terms of both improved groundwater quantities and quality. The promise of these legislative developments for groundwater recharge, however, is not clear. Aside from the purely technical problems of utilizing reclaimed wastewater for groundwater recharge, there are economic and institutional problems that may utlimately prove more crucial in determining the extent to which wastewater is reused. In this chapter, some of the economic and institutional problems associated with wastewater reuse are examined and the possibilities and desirabilities of reusing wastewater for groundwater recharge are assessed. The costs of groundwater recharge with reclaimed water are highly variable. In some localized instances wastewater recharge can be accomplished at costs that are competitively attractive. These instances are likely to be few, however, because of the substantial costs of treatment requirements and needs to convey or transport wastewater to spreading or injection sites. (See also W87-08137) (Lantz-PTT)
W87-08162

RESEARCH FOR GROUNDWATER QUALITY MANAGEMENT,
Robert S. Kerr Environmental Research Lab., Ada, OK.
C. W. Hall, M. D. Piwoni, and W. A. Pettyjohn.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 719-747, 4 fig, 31 ref.

Descriptors: *Artificial recharge, *Water reuse, *Groundwater quality, *Groundwater management, *Research priorities, *Water quality control, Groundwater pollution, Management planning, Path of pollutants.

Groundwater research strategy considerations are divided into three areas based on the types of processes that will affect pollutant movement in the subsurface: (1) hydrologic, (2) abiotic, and (3) biotic. Research under each of these process areas is further organized into a skeleton of research elements focusing on methods development, subsurface characterization, pollutant attentuation, process kinetics, field application, and mathematical model development and application. Each of these research elements represents a series of tasks or specific questions that need to be addressed. The research elements are intended to serve as a first-level planning base for use by groundwater research planners. The elements facilitate the orderly development of a series of specific research topics, or tasks, which need to be addressed to expand the existing knowledge of pollutant subsurface behavior. It is at the task level that the inherent flexibility of this arrangement becomes apparent. The addition of tasks under the various research elements will be a somewhat continuous process, at least through the early years of a research program. The research element outline will provide a skeleton for organization and direction of these tasks. Attempts to compartmentalize environmental processes are doomed to failure unless constant attention is paid to the interactions of the compartments as they occur in the natural systems. This chapter provides an organized approach to planning both short- and long-term groundwater quality research. It should be available to government personnel charged with matching budgeted funds to priority reserach areas and to research people responsible for the conception, design, and conduct of groundwater research. Following this evolving outline, the regulatory and research groups can proceed in an orderly fashion toward solving the problems posed by groundwater contamination. (See also W87-08137) (Lantz-PTT)
W87-08163

GROUND WATER MANUAL FOR SMALL COMMUNITIES,
Espey, Huston and Associates, Inc., Austin, TX.
For primary bibliographic entry see Field 2F.
W87-08236

WIPP HYDROLOGY PROGRAM WASTE ISOLATION PILOT PLANT SOUTHEASTERN NEW MEXICO: HYDROLOGIC DATA REPORT 3,
INTERA Technologies, Inc., Austin, TX.
For primary bibliographic entry see Field 2F.
W87-08245

EXAMPLE OF AUTOMATIC CONTROL OF WATER QUALITY (UN EXEMPLE DE CONTROLE AUTOMATIQUE DE LA QUALITE DES EAUX),
Service des Eaux, Services Industriels de Geneve (Switzerland).
For primary bibliographic entry see Field 5G.
W87-08518

STRATEGY FOR MANAGING DEPLETED AQUIFERS,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
W. Whipple.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 368-377, May 1987. 5 fig, 5 ref.

Descriptors: *Aquifer management, *Groundwater, *New Jersey, *Aquifers, *Conjunctive use, Water conservation, Recharge.

Although the engineering basis for managing depleted aquifer systems has been theoretically established, governmental management of such systems has been slow to develop, due to various economic, legal and institutional constraints. New Jersey, one of a number of states facing severe groundwater problems, has been successful in developing an approach which will reduce user withdrawals from depleted aquifers, while requiring all users to contribute to the cost of the necessary alternative surface supplies. Conjunctive use arrangements, water conservation, and recharge will be facilitated by this approach. (Author's abstract)
W87-08594

4C. Effects On Water Of Man's Non-Water Activities

URBAN AND RECREATIONAL LANDS: CONSERVATION NEEDS, TECHNOLOGY, AND POLICY ALTERNATIVES,
Wisconsin Univ.-Madison.
M. T. Beatty, F. P. Miller, W. D. Anderson, R. L. Barrows, and J. Konrad.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc, Madison, Wisconsin, 1981. p 141-171, 41 ref.

Descriptors: *Water conservation, *Urban areas, *Recreation, *Research priorities, *Policy making, Recreation wastes, Waste disposal, Fate of pollutants, Water supply, Water demand, Water quality, Land use, Erosion control, Sedimentation, Water use efficiency, Resources management.

As rural lands are converted to areas for urban and recreational use, the quality of soil and water resources may be degraded, thus imposing economic and social costs on the community, state, and nation. Technologies for more efficient water use should be applied to reduce the consumptive uses of water for urban, agricultural, and energy-related purposes. Alternative institutional arrangements should be developed and tested at the political jurisdiction or watershed level to make more efficient use of water. Recharge and temporary storage should be utilized to stabilize water supplies. Nonpoint-source-pollution models should be simplified to aid the decision making process. Research on the processes of urban-land conversion is needed to determine the economic, social, and energy costs and benefits of alternative polices. Interdisciplinary research in soil science, geology, and hydrology is needed to characterize the ranges in properties and spatial variabilities of soils and underlying geological materials and express them in terms of probabilities or confidence limits. Interdisplinary research is also needed to develop techniques for modifying land uses or construction methods to compensate for inherent soil problems and to develop models for predicting long-term and large-scale effects of water-disposal systems on soil, surface water, and groundwater. The relationships between recreational land uses and environmental impacts should be evaluated. (See also W87-07680) (Geiger-PTT)
W87-07688

DRASTICALLY DISTURBED LANDS: CONSERVATION NEEDS, TECHNOLOGY, AND POLICY ALTERNATIVES,
Southern Plains Range Research Station, Woodward, OK.
W. A. Berg, C. M. Smith, E. F. Aldon, I. Ballew, and R. L. Beck.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc, Madison, Wisconsin, 1981. p 173-184, 8 ref.

Descriptors: *Mine wastes, *Water pollution control, *Research priorities, *Land reclamation, *Water management, Water policy, Resources management, Soil conservation, Soil management, Soil erosion, Environmental effects, Earthworks, Wind erosion, Water quality control, Waste disposal.

Drastic land disturbances by mining, mineral-waste disposal, and earth construction greatly alter soil, water, land use, and aesthetics. Adverse effects of drastic disturbances on the environment and land use can be reduced, and in some cases nullified, by timely, well-planned reclamation based on experience and research. Disturbed-land research must find ways to reduce reclamation costs, optimize productivity of reclaimed areas, and validate performance requirements. These objectives may be accomplished by integrating reclamation with mining and earth construction, balancing land disturbances and environmental quality, and planning reclamation for long-term site stability. The recharge capacity of affected aquifers must be restored. Critical environmental factors must be identified and standardized monitoring procedures developed. Alternative, energy-efficient reclamation techniques for achieving long-term stability and for water and air-pollution control in mineral waste disposal sites should be evaluated along with process methods to make mineral waste more suitable for alternative uses or disposal. Improved methods to minimize erosion and stream sedimentation must be developed. Regulations for contouring and topsoiling must be evaluated to determine whether requirements are realistic and cost-effective for achieving stability of soil and spoil material. (See also W87-07680) (Geiger-PTT)
W87-07689

EFFECTS OF RESIDUE HARVESTING ON WATER RUNOFF, SOIL EROSION, AND NUTRIENT LOSS,
Agricultural Research Service, Morris, MN. North Central Soil Conservation Research Center.
M. J. Lindstrom.
Agriculture, Ecosystems and Environment, Vol. 16, No. 2, p 103-112, June 1986. 5 tab, 13 ref.

Descriptors: *Water yield, *Residue cover, *Tillage effects, *Runoff, *Rainfall-runoff relations, *Agricultural runoff, *Soil erosion, *Nutrient removal, Cropland, Farm wastes, Soil organic matter, Litter, Detritus.

The harvest of crop residues after grain production is a common practice in many management systems. Crop residues are used on the farm for feed and bedding. Recently, off-farm use as raw material for energy production and/or other manufactured products has been suggested. The implied assumption is that crop residues are a waste product and have no value when left on the land. Crop residues, however, have an important role in maintaining soil organic matter content, soil physical and chemical properties, and in controlling both wind and water erosion. A study was conducted to determine residue availability for harvest in various regions of the USA. Soil erosion potential, as determined by the universal soil loss equation or wind loss equation, was the only constraint placed on availability of crop residue for harvest. Areas where residue harvest may be feasible were identified but caution was recommended as residue harvest could only be justified if the long-term impact on soil productivity proved to be inconsequential. A new study was initiated on natural runoff plots to determine the effect of tillage management systems and levels of crop residue harvesting on water runoff, soil erosion and nutrient removal from the cropping system. Increased levels of corn (Zea mays) stover harvest resulted in increased water runoff and soil erosion. Nutrient removal from the cropping system generally exceeded standard fertilization practices when either high levels of corn stover were harvested or soil erosion levels approached the soil loss tolerance level of 11.2 tons/ha/yr. (McFarlane-PTT)
W87-07821

DESERTIFICATION PROCESSES AND IMPACT IN RAINFED AGRICULTURAL REGIONS,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 6G.
W87-07993

DESERTIFICATION PROCESSES AND IMPACTS IN IRRIGATED REGIONS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
For primary bibliographic entry see Field 6G.
W87-07994

EVALUATING THE WETLAND RESOURCE,
Silsoe Coll. (England).
J. Morris.
Journal of Environmental Management JEVMAW, Vol. 24, No. 2, p 147-156, March 1987. 1 fig, 28 ref.

Descriptors: *Agriculture, *Reviews, *Economic aspects, *Wetlands, Water resources, Planning, Decision making, Costs, Environment.

An economic framework for examining the competition between agriculture and the environment is outlined briefly. With particular reference to wetlands, it reviews possible methods for identifying and measuring costs, benefits, and impacts, and considers their contribution to resource decisions. (Author's abstract)
W87-08084

COMPARATIVE HYDROLOGICAL BEHAVIOUR OF FORESTED AND CLEARED CATCHMENTS IN SOUTHEASTERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
For primary bibliographic entry see Field 2A.
W87-08119

EFFECT OF PARTIAL AND CLEARCUTTING ON STREAMFLOW AT DEADHORSE CREEK, COLORADO,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
C. A. Troendle, and R. M. King.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 145-157, March 1987. 3 fig, 2 tab, 18 ref.

Descriptors: *Rainfall-runoff relationships, *Subalpine forests, *Deadhorse Creek, *Clearcutting, *Streamflow, *Forest management, Water yield, Drainage areas, Flow, Watersheds, Colorado, Streams, Tree harvesting.

Two subalpine forest subdrainages of Deadhorse Creek, Colorado, USA were used to demonstrate the comparable impact on water yield of two tree-harvesting practices. Of the 40 ha North Fork subdrainage 36% was clearcut commercially using five-tree height circular openings. In contrast, 40% of the basal area on the 41 ha Unit 8 was removed by partial cutting in the first step of a three-step shelterwood cut. Annual flow and peak flow from the clearcut watershed were increased significantly. The partial cut resulted in a significant increase in total water equivalent in the winter snowpack and an apparent increase in total annual streamflow that was comparable to the clearcut. The timber harvest on the two subdrainages, however, represented only 10% of the total basal area of the larger Deadhorse Creek Watershed in which they are located. Annual flow at the mainstream gage was not significantly increased as a result of harvest. (Author's abstract)
W87-08125

HYDROLOGIC SITE SELECTION FOR MINING OF DEEP BASIN LIGNITE IN TEXAS,
Texas Univ. at Austin. Center for Research in Water Resources.
R. J. Charbeneau, S. G. Wright, C. D. Shackelford, A. T. Talley, and H. D. Yeh.
Technical Report No. CRWR 198, December 1983. 113 p, 41 fig, 6 tab, 44 ref. Texas Energy and Natural Resources Advisory Council Contract No. IAC(82-83)0777.

Descriptors: *Site selection, *Lignite, *Mining, *Texas, Geohydrology, Gasification, Groundwater quality, Environmental effects, Groundwater recharge.

The subject of this research is the hydrological and geomechanical feasibility and impact of open pit mining and underground coal gasification for recovery of deep basin Texas lignite. Of major concern are the quantities and uses of water from site dewatering and depressurizing operations, the stability of open pit mine slopes and how it is influenced by water, and the regional hydrologic impacts of lignite mining. The objectives of this phase of research have been to establish representative hydrogeologic settings in which lignite mining in Texas may take place, to develop analytical tools for use in the study of these hydrogeologic settings, and finally to assess the potential impact of UCG mining of lignite on the regional groundwater hydrology of each of the settings. The first of these objectives was met by researching the geologic literature and developing a composite picture of the 'typical' hydrogeologic setting for lignite coal in Texas. The results of these efforts are presented as the 'type' geologic settings presented in this report. The second objective was met by tailoring an existing finite element groundwater flow code to the specific needs of this particular study. Several observations are relevant to a discussion of potential impact of UCG mining on regional groundwater hydrology. First of all, it is clear that groundwater flows are imapcted and diverted toward the disturbed region on both a regional and local scale. The magnitude of this impact however is variable at best and perhaps still largely unknown. However, indications are that the impact on groundwater supplies for surface uses may be considered to be minimal. The impact on areas of discharge is to divert flows to the cavity and then on toward the surface. Slower flow settings show reduced impact on regional groundwater hydrology. These considerations lead to the conclusion that the Jackson geologic setting in an area of groundwater recharge offers the conditions for the least impact on groundwater hydrology resulting from UCG mining in Texas. (Lantz-PTT)
W87-08222

MANUAL FOR HIGHWAY STORM WATER PUMPING STATIONS: VOLUME 1.
Lever (William F.) and Associates, Long Beach, CA.
For primary bibliographic entry see Field 8C.
W87-08248

CULTURAL RESOURCES ALONG A MAJOR TRAIL IN THE BIG MARIA MOUNTAINS, RIVERSIDE COUNTY, CALIFORNIA,
ASM Affiliates, Inc., San Diego, CA.
For primary bibliographic entry see Field 6G.
W87-08250

BATTLE OF THE BOG,
D. Thompson.
New Scientist NWSCAL, Vol. 113, No. 1542, p 41-44, January 1987. 3 fig.

Descriptors: Decriptors: *Bogs, *Peat bogs, *Forestry, Scotland, Economic aspects, Spruce trees, Pine trees, Wetlands, Mosses, Aquatic plants, Peat.

Open, treeless moorlands cover almost 400,000 hectares of the northern Highlands of Scotland. The mantle of peat and sphagnum moss which blanket this area supports a flora and fauna representative of arctic tundra. Developers, spurred by governmental financial incentives, are destroying more than 50 hectares per week of this blanket bog to plant trees. Technical advances in plowing and in propagating tree seedlings, coupled with tax incentives and government grants of up to 70% of costs, have encouraged developers to extend forest plantations into regions previously considered unsuitable. Blanket peat deeper than half a meter is now considered suitable for growing trees. In Sutherland and Caithness, this represents 65% of the peatland, and state and private developers have already planted trees on 16% of this. Although growing conditions for trees are marginal, sitka spruce and lodgepole pines are being planted. Trees grow slowly and are subject to wind blowover under these conditions. Forestry operations appear to be damaging salmon fishing, as peat erosion and drainage operations cause rivers to silt up. Birds which nest on boglands are more subject to predation by crows and foxes that inhabit the new tree plantations. A drop in water level of only 4 or 5 cm can lead to significant changes in bog vegetation and even loss of certain species. (McFarlane-PTT)
W87-08256

COPPER, CADMIUM, AND NICKEL ACCUMULATION IN CRAYFISH POPULATIONS NEAR COPPER-NICKEL SMELTERS AT SUDBURY, ONTARIO, CANADA,
Laurentian Univ., Sudbury (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-08269

EFFECT OF URBANIZATION ON THE GROUNDWATER OF LIMESTONE ISLANDS: AN ANALYSIS OF THE BERMUDA CASE,
Public Works Dept., Hamilton (Bermuda).
For primary bibliographic entry see Field 5B.
W87-08532

4D. Watershed Protection

HIGH TECH APPROACH TO URBAN STORMWATER MANAGEMENT,
Austin Dept. of Public Works, TX. Watershed Management Div.
For primary bibliographic entry see Field 5G.
W87-07939

WATER EROSION CONTROL,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
D. W. Sanders.
Climatic Change CLCHDX, Vol. 9, No. 1/2, p 187-194, August-October 1986.

Descriptors: *Water erosion, *Erosion control, *Ecological effects, *Land management, *Soil conservation, *Watershed management, *Desertification, *Erosion, Vegetation, Vegetation effects, Environmental effects, Agriculture, Grazing, Cultivated lands, Forest management, Cropland, Conservation, Arid lands, Sheet erosion, Rill erosion, Gully erosion, Cultivation, Drainage, Ecosystems.

Some techniques to control water erosion are examined, based on the selection and introduction of correct land use. Practices pertaining to agricultural land include rotations, relay planting, mulch tillage, minimum and no-tillage, suitable cultivation practices, use of appropriate machinery, and strip cropping. Practices for grazing land include controlled grazing rates, rotational grazing, fodder conservation, and avoidance of concentrating livestock. Practices for forestry land include controlled logging, maintenance of ground cover, and control of indiscriminate cutting. Erosion can be controlled in other land uses (building, road construction, and recreational sites) through careful planning and the use of some special measures. Mechanical erosion control measures discussed include contour cultivation, contour banks, graded banks with waterways, bench terracing, gully head structures, silt traps, groins or piers, and dams. It is concluded that the most important principle in controlling water erosion is to develop a new, balanced system that is not only productive but stable. (Author's abstract)
W87-07998

WEAVER BOTTOMS TARGETED FOR RESTORATION,
Upper Mississippi River National Wildlife and Fish Refuge, Winona, MN.
For primary bibliographic entry see Field 6G.
W87-08007

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EVALUATION OF A TANGENTIAL-FLOW MULTIPLE-FILTER TECHNIQUE FOR DETECTION OF GIARDIA LAMBLIA CYSTS IN WATER,
British Columbia Univ., Vancouver. Provincial Labs.
J. L. Isaac-Renton, C. P. J. Fung, and A. Lochan.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 400-402, August 1986. 1 fig, 1 tab, 7 ref.

Descriptors: *Giardia, *Filtration, *Water analysis, *Drinking water, Water sampling, Parasites, Aquatic animals, Protozoa, Sampling, Sample preparation, Feces, Diseases, Human diseases, Public health, Performance evaluation.

The Millipore Pellicon cassette system was evaluated as a method of concentrating water for detecting the infective cyst state of Giardia lamblia in drinking water. This system consists of a high-volume cell (filter holder) which manifolds incoming fluids, distributing them in tangential-flow paths across parallel layers of membrane. Cysts were obtained from infected human feces and harvested using a sucrose gradient. The overall recovery of inoculated cysts using the cassette system was 31%. Recovery rates of the most widely-used current procedure (EPA method), using a wound-orlon system of through-filtration, were found to be about 5 to 15%. The use of tangential-flow filtration is recommended as the more sensitive method of sample concentration and cyst recovery. (Author's abstract)
W87-07601

INVESTIGATION OF A CHEMILUMINESCENT SYSTEM FOR THE DETERMINATION OF AMMONIA BY FLOW-INJECTION ANALYSIS,
Michigan State Univ., East Lansing. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W87-07619

CAN GRAIN ABSORB VOLATILE PHENOLS FROM IRRIGATING WATER: THIN-LAYER CHROMATOGRAPHY OF STEAM-VOLATILE PHENOLS IN THE WASTE WATER OF THE PETROLEUM INDUSTRY AND THE GRAIN IRRIGATED BY IT,
Agricultural Biology Research Inst., Beijing (China).
D. Liu, H. Bao, and F. Wei.
Analytical Letters ANALBP, Vol. 20, No. 2, p 235-257, February 1987. 6 fig, 4 tab, 5 ref.

Descriptors: *Impaired water use, *Analytical methods, *Thin layer chromatography, *Phenols, *Industrial wastewater, *Path of pollutants, *Grain, *Rice, Irrigation, Wastewater, Organic compounds, Petroleum industry, Chromatography.

A simple TLC separation and semi-quantitative visual determination method was used to analyze the volatile phenols in the wastewater of the petroleum industry and the grain irrigated by the wastewater. The phenol in the rice irrigated by the water that contained phenol for artificial preparation was also studied. A preliminary conclusion was obtained, that the grain could absorb volatile phenols from irrigation water. (Author's abstract)
W87-07620

SPECIATION OF MANGANESE IN FRESH WATER - I: USE OF EPR STUDIES,
Queensland Univ., Brisbane (Australia). Dept. of Chemistry.
B. Chiswell, and M. B. Mokhtar.
Talanta TLNTA2, Vol. 34, No. 3, p 307-311, March 1987. 2 fig, 6 tab, 16 ref.

Descriptors: *Electron paramagnetic resonance spectrometry, *Analytical methods, *Manganese, Speciation, Ions, Natural waters, Comparison studies, Spectral analysis, Complexation, Humic acids, Metals.

The process of standardization of the use of electron paramagnetic resonance (EPR) spectrometry in the determination of Mn(II) species in aqueous solution by comparison with atomic absorption spectrometry (AAS) is discussed. It is shown that EPR signals obtained from standardized aqueous solutions of manganese (II) perchlorate and nitrate in the concentration range of 0.05-2 mg/l. do not vary significantly over the pH range 2.1-7.0. Study of the effect (on the manganese EPR signals) of the addition of inorganic ions commonly found in significant concentrations in natural waters, viz. chloride, sulfate and bicarbonate, has shown that such ions, at the levels reported to occur in surface fresh waters, will not complex manganese(II); however, evidence is obtained that humic acid/manganese complexes could be present in such waters. The EPR signals are not affected by ionic strengths of the levels found in fresh waters. (Author's abstract)
W87-07625

EXTRACTION AND PRECONCENTRATION OF SELENIUM FROM AQUEOUS SOLUTIONS AND ITS DETERMINATION IN WATER AND HAIR SAMPLES BY ATOMIC-ABSORPTION SPECTROPHOTOMETRY,
King Abdulaziz Univ., Jeddah (Saudi Arabia). Dept. of Chemical Engineering.
M. Ejaz, and M. A. Qureshi.
Talanta TLNTA2, Vol. 34, No. 3, p 337-340, March 1987. 3 fig, 2 tab, 18 ref.

Descriptors: *Analytical methods, *Sample preparation, *Extraction, *Preconcentration, *Selenium, *Atomic absorption spectrophotometry, Spectral analysis, Solutions, Organic solvents, Performance evaluation.

Several organic solvents, including benzene, xylene, toluene, nitrobenzene, chloroform, carbon tetrachloride, chlorobenzene and high molecular-weight pyridines such as 4-(3-nonyl)pyridine, 2-hexylpyridine and benzylpyridine were investigated as components of systems for the extraction and preconcentration of selenium from nitric acid solutions containing iodide. The results are discussed in terms of choice of reagents and the acid and iodide concentrations, and of several other parameters affecting the extraction. The utility of the method for separation of selenium from aqueous solution was evaluated. The method was used for preconcentration of trace levels of selenium from water and hair samples for determination by atomic-absorption spectrophotometry. (Author's abstract)
W87-07626

DEVELOPMENT AND EVALUATION OF CLOUD WATER COLLECTIONS,
Nevada Univ. System, Reno. Atmospheric Sciences Center.
For primary bibliographic entry see Field 7B.
W87-07653

HYDROCARBONS IN SOUTHERN CALIFORNIA MUNICIPAL WASTES AND THEIR INPUT TO COASTAL WATERS,
Massachusetts Univ. at Boston. Environmental Science Program.
R. P. Eganhouse, and, I. R. Kaplan, and D. L. Blumfield.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 159-186, 8 fig, 6 tab, 38 ref. Bureau of Land Management Contract EY-76-3-03-0034.

Descriptors: *Pollutant identification, *Coastal waters, *Waste disposal, *Municipal wastes, *Hydrocarbons, *Water pollution sources, *California, *Path of pollutants, Ocean dumping, Gas chromatography, Mass spectrometry, Municipal wastewater.

Hydrocarbons isolated from the municipal wastes of southern California were measured gravimetrically and analyzed by high-resolution gas chromatography and gas chromatography-mass spectrometry. Mean total hydrocarbon contents of those effluents receiving mostly primary treatment ranged from 6.1 to 16.3 mg/L, whereas in sludge the concentrtions were approximately 340 mg/L. Most of the hydrocarbons (56-77%) were not resolvable by high-resolution gas chromatography. Those that were consisted mainly of homologous series such as the normal, iso-, and acyclic isoprenoid alkanes; alkylcyclohexanes; substituted benzenes; polycyclic aromatics and terpenoids. The virtual absence in effluents of 17 alpha(H), 18 alpha(H), 21beta(H)-28, 30-bisnorhopane, a specific marker of California oils, indicates that nonlocal sources are the dominant contributors of petroleum to the wastewaters. Long-chain linear alkylbenzenes, similar in homolog and isomer distribution to the linear alkylbenzene sulfonate (LAS)-type surfactants commonly used in commercial detergents, were also found. The preservation of these synthetic compounds in sediments deposited near one of the major sewage outfall systems suggests their potential use as molecular tracers of domestic wastes. The estimated mass emission rate of hydrocarbons from southern California's treatment plants to the ocean is 175,000 tons/yr, or 4.9 g/capita/day. This is approximately double the input rate due to surface runoff in this region and represents nearly 6% of the currently accepted estimate for the global input of municipal wastewater-borne petroleum. (Author's abstract)
W87-07736

METALS IN INTERSTITIAL WATERS OF THE NEW YORK BIGHT DREDGED-MATERIAL DEPOSIT,
Dynamics Solutions Corp., Pasadena, CA.
M. G. Heaton, and R. Dayal.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 235-249, 2 fig, 4 tab, 26 ref.

Descriptors: *Coastal waters, *Pollutant identification, *Heavy metals, *Interstitial water, *New York Bight, *Waste disposal, *Path of pollutants, Dredging, Iron, Manganese, Zinc, Copper, Cadmium, Mercury.

As part of a geochemical and sedimentological study of the New York Bight dredged-material deposit, interstitial waters were extracted from deposit sediment cores and examined for dissolved Fe, Mn, Zn, Cu, Cd, and Hg. Pore water data indicated a sediment-derived diffusive flux of dissolved Fe and Mn to overlying water. The estimated Fe and Mn fluxes were highly variable, depending upon station location and the interstitial metal. The Fe flux varied from 0.62 to 3.8 g/sq m/yr, whereas the Mn flux ranged from 0.030 to 0.29 gm/sq m/yr; these fluxes were two to three orders of magnitude lower than the input of Fe and Mn associated with dredged-material dumping. Zinc was present in interstitial waters at concentrations comparable to those measured previously in bottom waters near the dredged-material dumpsite; diffusive flux of this metal will vary in direction and magnitude as a function of location and bottom-water concentration. Other metals such as Cu, Cd, and Hg were present at extremely low concentrations in the pore waters, indicating that their diffusive flux is negligible. (See also W87-07729) (Author's abstract)
W87-07739

ORGANIC POLLUTANTS IN NEW YORK BIGHT SUSPENDED PARTICULATES,
Battelle New England Marine Research Lab., Duxbury, MA.
For primary bibliographic entry see Field 5B.
W87-07740

BACTERIOLOGICAL CONTROL OF DISTRIBUTED WATER (LE CONTROLE BACTERIOLOGIQUE DES EAUX DE DISTRIBUTION),
For primary bibliographic entry see Field 5F.
W87-07789

IDENTIFICATION OF NOVEL WIDELY DISTRIBUTED SEDIMENTARY ACYCLIC SESTERTERPENOIDS,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
J. N. Robson, and S. J. Rowland.
Nature NATUAS, Vol. 324, No. 6097, p 561-563, December 1986. 3 fig, 1 tab, 29 ref.

Descriptors: *Tracers, *Sesterterpenoids, *Sediments, Bacteria, Indicators, Geothermal stress, Hydrocarbons, Saline water.

Isoprenoids, the general class of natural products biosynthesized from isoprene units, are abundant in nature. Many isoprenoids are also found in sediments, sedimentary rocks and crude oils where they have proved useful as chemical fossils of biological activity and as indicators of geothermal stress. However, acyclic isoprenoids with 25 carbon atoms - so called sesterterpenoids - have been reported only rarely in the biosphere and the geosphere. Indeed, the only acyclic sesterterpenoids of confirmed structure reported in sediments are pentamethyleicosane structural isomers. For example, 2,6,10,14,18 - pentamethyleicosane has been proposed as a marker for halophilic bacteria and the 2,6,10,15,19-isomer as an indicator of methanogens. The authors have identified a group of novel sesterterpenoids that are major components of the hydrocarbons of recent fresh water, marine and hypersaline parts of the globe. Because they have unusual structures, these sesterterpenes show promise as a new class of biological marker compounds. (Author's abstract)
W87-07801

MICROBIOLOGICAL QUALITY OF BOTTLED WATER SOLD IN CANADA,
Health and Welfare Canada, Ottawa (Ontario). Food Directorate.
For primary bibliographic entry see Field 5G.
W87-07818

CONTINUOUS-FLOW REAL-TIME AND FLOW INJECTION DETERMINATION OF RAINWATER PH WITH A POLY(VINYL CHLORIDE)-BASED TUBULAR MEMBRANE ELECTRODE,
University of Central Florida, Orlando. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W87-07824

EXTRACTION OF ORGANIC CONTAMINANTS IN AQUEOUS SOLUTIONS BY PERVAPORATION,
California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.
For primary bibliographic entry see Field 5D.
W87-07857

COLOR ENHANCES ACCURACY OF CONTINUOUS WASTEWATER ANALYSES,
For primary bibliographic entry see Field 7B.
W87-07923

DIOXIN TESTING IN KILL VAN KULL,
M. Kraut.
Public Works PUWOAH, Vol. 117, No. 12, p 42-43, December 1986.

Descriptors: *Dioxins, *Water analysis, *Chemical analysis, *Kill van Kull, New Jersey, *Dredging, *Bottom sampling, *Contamination, Sampling, Assay, Bioassay, Bioaccumulation, Water pollution effects, Waste disposal.

Channels in the Kill van Kull and Newark Bay, NJ are undergoing tests to determine if dioxins are present in their sediments. The tests are sponsored by the Corps of Engineers along with the Port Authority of New York and New Jersey, since the Corps has plans to dredge the channels. Core samples were taken in September, 1986 from a 45-ft survey vessel. If dioxin concentrations are found to be above the critical level of 1 ppb, bioassay and bioaccumulation tests will be performed to determine the likely effects of the toxin on aquatic life through all levels of the food chain. The planned dredging calls for increasing the channel depths from an average of 35 ft to 40 ft, and eventually to 44 ft in order to accommodate modern container ships. The project is expected to cost $330 million. (Doria-PTT)
W87-07941

CHROMATOGRAPHIC DETERMINATION OF SOME TRACE ORGANIC IMPURITIES IN NATURAL AND WASTE WATERS WITH PRELIMINARY ADSORPTION TRAPPING,
Ministerstvo Khimicheskoi Promyshlennosti SSSR, Moscow.
N. N. Senin, Y. S. Filippov, N. F. Tolikina, G. A. Smol'yaninov, and S. A. Volkov.
Journal of Chromatography JOCRAM, Vol. 364, p 315-321, September 1986. 2 fig, 5 tab, 11 ref.

Descriptors: *Analytical methods, *Gas chromatography, *Trace levels, *Organic compounds, *Contaminants, *Adsorption, *Chemical analysis, *Water analysis, *Wastewater analysis, *Pollutant identification, Trapping, Wastewater, Industrial wastewater, Gas chromatography, Enrichment, Particle size, Polymers, Herbicides, Monuron, Diuron, Monitoring, Water pollution, Contamination, Pesticides, Urea pesticides.

A technique is presented for the determination of trace amounts of butyl acetate in industrial effluents based on preliminary adsorption trapping on grade TSVK-11a zeolite, and gas chromatographic separation on columns packed with DC-550 and Carbowax 1500. The degree of extraction and enrichment were determined. The degree of butyl acetate extraction was studied as a function of the mass of zeolite and its particle dimensions, and these characteristics were compared with the data obtained under similar conditions on the polymeric sorbents Chromosorb 102 and Polysorb I. To determine herbicides based on substituted phenylureas (e.g., monuron, diuron) in natural water, high-performance liquid chromatography was used in combination with trapping on Chromosorb 102. The sorbate was analyzed on a Partisil ODS column using water-acetonitrile as the mobile phase and a 254-nm UV detector. The trapping increases detection sensitivity to 0.0001 mg/l. (Author's abstract)
W87-07958

TRACE ANALYSIS OF SOME CHLORINATED HYDROCARBONS IN WATERS BY GAS-LIQUID CHROMATOGRAPHY,
Akademie der Wissenschaften der DDR, Leipzig. Forschungsstelle fuer Chemische Toxikologie.
M. Mohnke, K.-H. Rohde, L. Brugmann, and P. Franz.
Journal of Chromatography JOCRAM, Vol. 364, p 323-337, September 1986. 4 fig, 6 tab, 17 ref.

Descriptors: *Analytical methods, *Trace levels, *Chemical analysis, *Water analysis, *Pollutant identification, *Gas liquid chromatography, *Chlorinated hydrocarbons, Chromatography, Hydrocarbons, Polychlorinated biphenyls, DDT, Sampling, Sulfuric acid, Electron capture gas chromatography, Environment, Aquatic environment, Water pollution, Sample preparation, Seawater.

A composite analytical procedure is proposed for the determination of some chlorinated hydrocarbons in natural waters in the low ppt range. Compounds studied include PCBs, hexachlorobenzene, DDT metabolites, and four hexachlorocyclohexane isomers. The procedure includes sampling by 23.5-l balloons to a depth of 1,500 m and by a microlayer screen sampler; extraction by turbo-stirring directly in the sampler with n-hexane; clean up with sulfuric acid; and instrumental detection by packed column gas chromatography with electron-capture detection. The procedure proved to be accurate, precise, and simple. Values obtained from four expeditions between 1980 and 1984 using the method yielded results comparable with those received from glass capillary column gas chromatography, and are of sufficient quality for use in baseline studies in the Baltic Sea and adjacent areas. (Author's abstract)
W87-07959

GAS CHROMATOGRAPHIC DETERMINATION OF ORGANIC COMPONENTS IN EFFLUENTS FROM MILLS FOR PROCESSING WASTE PAPER,
Ukrainskii Nauchno-Issledovatel'skii Inst. Tselliuloznoii Bumazhno Promyshlennosti, Kiev (USSR).
O. I. Kalchenko, V. O. Volovenko, K. I. Sakodynskii, and V. P. Svitelskii.
Journal of Chromatography JOCRAM, Vol. 364, p 339-344, September 1986. 2 fig, 3 tab, 4 ref.

Descriptors: *Effluents, *Analytical methods, *Sample preparation, *Gas chromatography, *Organic compounds, *Industrial wastewater, *Pulp and paper industry, *Pollutant identification, *Wastewater analysis, Chromatography, Wastewater, Chemical analysis, Fatty acids, Esters, Phenols, Alcohols, Contamination, Retention time, Reagents.

Organic components in effluents from mills for processing waste paper were studied by gas chromatography before and after treatment. Fatty acids, esters, phenols, and alcohols were determined at concentrations from 0.01 to 0.5 mg/l. Compounds were identified on the basis of retention time and by reference spots. It is concluded that the generally accepted method of using diethyl ether for separating the neutral fraction of the organic substances is unsatisfactory, because the ether extracts contain considerable amounts of compounds that interfere with detection. Use of n-hexane for separating the neutral fraction promotes the selective extraction of non-polar substances under mild conditions; moreover, the number of operations in the extraction prior to chromatographic analysis is reduced and losses during concentration are decreased, while the amount of information provided by the chromatograms is increased. The neutral fraction of board mill effluent was found to be mainly represented by ethers of aliphatic and hydroxy acids. (Author's abstract)
W87-07960

SULPHATE IN BOG WATERS: A COMPARISON OF ION CHROMATOGRAPHY WITH MACKERETH'S CATION-EXCHANGE TECH-

NIQUE AND A REVISION OF EARLIER VIEWS ON CAUSE OF BOG ACIDITY,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
E. Gorham, and N. E. Detenbeck.
Journal of Ecology JECOAB, Vol. 74, No. 3, p 899-903, September 1986. 1 fig, 1 tab, 20 ref.

Descriptors: *Analytical methods, *Sulfates, *Bogs, *Chromatography, *Cation exchange, *Acidity, Colorimetry, Organic matter, Organic compounds, Humic acids, Wetlands, Ion exchange, Chemical properties, Color, Optical properties, Dissolved solids, Chemical interference, Anions, Sulfuric acid, Chemistry, Peat bogs, Ions, Sulfur, Sulfur compounds, Comparison studies.

Sulfate was measured by ion chromatography and by Mackereth's cation exchange technique in bog waters of variable color and dissolved organic matter. Mackereth's technique measures sulfate titrimetrically (to pH 4.5) or conductimetrically in the form of strong sulfuric acid after the passage of the water sample through a single cation-exchange column loaded at the top with silver ions (to remove chloride) and at the bottom with hydrogen ions. (The technique measures the sum of sulfate plus nitrate; the nitrate must be analyzed separately and subtracted.) Mackereth's technique yielded considerably higher concentrations, and the difference in concentration between the two techniques was found to correlate strongly with sample color. It is concluded that colored organic ions are measured along with sulfate by Mackereth's technique, and that inferences made earlier by Gorham concerning sulfuric acid as a major cause of acidity in pristine bogs are invalid. (Author's abstract)
W87-07965

ACETYLENE REDUCTION RATE AS A PHYSIOLOGICAL INDICATOR OF THE RESPONSE OF FIELD-GROWN SOYBEANS TO SIMULATED ACID RAIN AND AMBIENT GASEOUS POLLUTANTS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W87-07980

HEAVY METAL TRACE DETERMINATION WITH A COMPACT THERMAL IONIZATION QUADRUPOLE MASS SPECTROMETER. PART I. ANALYSIS OF SEWAGE SLUDGES, SOILS AND ANALOGOUS MATERIALS (SCHWERMETALL-SPURENBESTIMMUNG MIT EINEM KOMPAKTEN THERMIONEN-QUADRUPOL-MASSENSPEKTROMETER TEIL 1. ANALYSE VON KLARSCHLAMMEN, BODEN UND VERWANDTEN MATERIALIEN),
Regensburg Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie.
A. Gotz, and K. G. Heumann.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 325, No. 1, p 24-31, September 1986. 2 fig, 4 tab, 27 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Heavy metals, *Trace metals, *Pollutant identification, *Mass spectrometry, *Ionization, *Soil analysis, *Sludge, *Chemical analysis, Lead, Cadmium, Thallium, Copper, Zinc, Sediments, Phosphates, Rocks, Electrolysis, Ion exchange, Chromatography, Detection limits.

An analytical method is described for trace determinations of Pb, Cd, Tl, Cu, and Zn with isotope dilution mass spectrometry using a compact thermal ionization quadrupole instrument for measuring the isotope ratios. The method was used to analyze sewage sludges, soils, a sediment, a phosphate rock, and a city waste incineration ash. For standard reference materials, the results determined with the described isotope dilution technique and the quadrupole mass spectrometer agree well with the certified values. A comparison of results obtained with a magnetic sector field instrument with the results of the quadrupole mass spectrometer shows identical values within the limits of error. Therefore, the availability of the quadrupole thermal ionization mass spectrometer, which is a cost-efficient solution and an easy-to-handle instrument, establishes a stronger basis for the application of the isotope dilution technique. The detection limits for the described method are: 3 ng/g (electrolytic deposition) and 13 ng/g (chromatographic separation) for Pb, 2 ng/g for Cu, 6 ng/g for Cd and Tl, and 27 ng/g for Zn. These detection limits enable the analysis of all environmental samples of the described type with respect to the heavy metals mentioned. (Doria-PTT)
W87-07984

STABILITY SPECTRA FOR THE DESCRIPTION OF COPPER-HUMIC COMPLEXES: A FLUORESCENCE QUENCH STUDY,
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
F. H. Frimmel, and W. Hopp.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 325, No. 1, p 68-72, September 1986. 5 fig, 3 tab, 35 ref. Deutsche Forschungsgemeinschaft Bonn-Bad Godesberg Grant Fr 536-5.

Descriptors: *Stability analysis, *Spectral analysis, *Copper, *Humic acids, *Fluorescence, *Pollutant identification, *Chemical analysis, Heavy metals, Ions, Cations, Metals, Metal complexes, Equilibrium.

Complexation of heavy metals by aquatic humic substances (HUS) is important for understanding natural water systems. The principle of quenching of HUS fluorescence by paramagnetic metal ions was applied to their titration with copper (II) under defined reaction conditions (pH 6.8). Conditional stability constants (K') were determined for the assumption of 1:1 complex formation. Stability spectra were introduced to show the influence of the ligand-to-metal ratio of K'. K' for copper complexes of isolated HUS ranged from 2,000,000 to 100,000. This is in good agreement with other published data and results from other experimental methods. The fluorescence quench method can be extended for all paramagnetic metal ions and for competing diamagnetic ions and ligands. The concentration range covers the concentrations found in natural aquatic systems, making environmental interpretations possible. (Author's abstract)
W87-07985

EFFECT OF WATER ACTIVITY ON LEGIONELLA SPP. GROWTH AND SURVIVAL,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 5B.
W87-07989

COMPARATIVE STUDY OF DIFFERENT METHODS FOR DETECTION AND ENUMERATION OF SALMONELLA SPP. IN NATURAL WATERS,
Malaga Univ. (Spain). Dept. of Microbiology.
M. A. Morinigo, J. J. Borrego, and P. Romero.
Journal of Applied Bacteriology JABAA4, Vol. 61, No. 2, p 169-176, August 1986. 2 fig, 3 tab, 38 ref.

Descriptors: *Analytical methods, *Microbiological studies, *Water analysis, *Salmonella, *Culturing techniques, Pollutant identification, Biological analysis, Bacteria, Aquatic bacteria, Pathogenic bacteria, Culture media, Growth media, Water pollution, Public health, Isolation, Antibiotics.

Soil enrichment media for detecting salmonellas from polluted freshwater were compared. The Most Probable Number enumeration technique was used, directly adding filtered water to buffered peptone water as the pre-enrichment medium. Media tested include Rappaport-Vasiliadis/43 (RV/43), NR10/43 of Alcaide et al., RV/43 supplemented with several different concentrations of novobiocin, selenite broth, and selenite F broth, the last two under different incubation conditions. The highest average percentage of salmonellas recovered (86.66% of samples examined) was obtained with RV/43 and RV/43 supplemented with 10 micrograms/ml of sodium novobiocin. Recovery was poorest (< 10%) with selenite cystine and selenite F media at 36 C; percent recovery was increased by incubation at 43 C alone, or by addition of novobiocin (maximum 50%). It is concluded that the best medium for enumerating salmonellas in samples from moderately contaminated natural waters was the NR10(10)/43 broth, because it recovered concentrations of salmonellas equal to or higher than RV/43, and because an increase in the antibiotic concentration decreased the number of competitive organisms without apparently affecting the growth of salmonellas. (Doria-PTT)
W87-07990

METHOD FOR DETERMINING CONCENTRATIONS OF 220RN IN THE FIELD,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W87-07992

REVIEW AND TRENDS IN THE ANALYSIS FOR PCDD/PCDF,
Dow Chemical Co., Midland, MI. Analytical Labs.
W. B. Crummett, L. L. Lamparski, and T. J. Nestrick.
Toxicological and Environmental Chemistry TXECBP, Vol. 12, No. 1/2, p 111-135, 1986. 20 tab, 94 ref.

Descriptors: *Reviews, *Analytical methods, *Chemical analysis, *Pollutant identification, *Chlorinated dioxins, *Chlorinated furans, *Detection limits, Technology, Environmental quality, Radiochemical analysis, Chromatography, Sampling, Sample preparation, Performance evaluation, Spectrometers, Mass spectrometry, Tissue analysis, Fish, Milk, Particulate matter, Water analysis, Food.

Analytical processes for the detection and measurement of chlorinated dioxins in environmental samples are reviewed. Detection limits for environmental 2,3,7,8-TCDD have gone from parts per billion in 1970 to parts per quadrillion in 1983. The detection limit for the compound in products has gone from 1 ppm to 1 ppb. Specificity has improved from 20 isomers being included in the chromatographic peak used to measure the compound in 1966 to only one isomer in 1979. The choice of method depends on the matrix to be analyzed and the sensitivity, specificity, and degree of certainty required in the data. The importance of the sample extraction and cleanup process is also discussed; if this process is well done, high resolution mass spectrometry is not necessary, and less cleaning of the mass spectrometer is required. (Doria-PTT)
W87-08005

FLOW-INJECTION SPECTROPHOTOMETRIC DETERMINATION OF ALUMINIUM IN WATER WITH PYROCATECHOL VIOLET,
Norsk Inst. for Skogforskning, Aas.
O. Royset.
Analytica Chimica Acta ACACAM, Vol. 185, p 75-81, July 1986. 6 fig, 2 tab, 14 ref.

Descriptors: *Analytical methods, *Spectrophotometry, *Aluminum, *Water analysis, *Pyrocatechol violet, *Dyes, *Sample preparation, Optimization, Performance evaluation, Photometry, Chemical analysis, Detection limits, Chemical interference, Standard deviation, Calibrations, Ions, Organic matter, Organic compounds, Fulvic acids, Reagents.

Optimum conditions for the adaptation of the spectrophotometric pyrocatechol violet method for aluminum to a flow-injection system are described. The detection limit is 3 micrograms Al/l and calibration graphs are linear up to 3 or 10 mg/l (with 200- or 10-microliter injection loops, respectively). The relative standard deviation is < 2% at 0.1 mg Al/l. Potential interferences of 40 common inorganic ions and of 20 organic substances including fulvic acid are reported. It is concluded that the flow-injection method is sensitive, rapid, and reproducible. With the use of conventional masking agents and predigestion of samples with high organic content, the method is suitable for determination of total aluminum in natural waters. (Author's abstract)

W87-08017

DETERMINATION OF TRACE METALS IN SEDIMENT STANDARD REFERENCE MATERIALS BY GRAPHITE-FURNACE ATOMIC ABSORPTION SPECTROMETRY WITH A STABILIZED TEMPERATURE PLATFORM,
Ente Nazionale per l'Energie, Piacenza (Italy). Lab. Centrale.
For primary bibliographic entry see Field 2K.
W87-08018

EFFICIENCY OF CELLEX-P FOR THE PRECONCENTRATION OF LEAD AND OTHER TRACE METALS FROM WATERS,
Warsaw Univ. (Poland). Dept. of Chemistry.
K. Brajter, and K. Slonawska.
Analytica Chimica Acta ACACAM, Vol. 185, p 271-277, July 1986. 2 fig, 5 tab, 5 ref.

Descriptors: *Analytical methods, *Sample preparation, *Trace metals, *Water analysis, *Lead, *Chelating agents, Heavy metals, Performance evaluation, Pollutant identification, Esters, Copper, Nickel, Manganese, Cadmium, Zinc, Hydrogen ion concentration, Nitric acid, Resins, Ions, Cations, Detection limits, Ion exchange, Reagents, Chemical analysis, Retention time.

The chelating ion exchanger Cellex-P, a cellulose phosphate ester, was shown to be effective for the preconcentration of Cu, Ni, Cd, Zn, and Pb from water. Very high preconcentration factors were possible at high flow rates. The pH of the sample was not critical within the approximate range of 5-8. The collected ions can be eluted efficiently in 10-25 ml of 1 M nitric acid from 2-16.5-cm columns of resin. Common salts present in natural waters do not interfere. Atomic absorption spectrometry with electrothermal atomization was used to quantify the metals after elution. In most of the experiments, metal ions were added at 0.1 mg/l concentrations. Quantitative recoveries were also possible when the concentration of each metal ion was 0.05 or 0.01 mg/l. Therefore, the method is applicable over a reasonably wide concentration range. It is concluded that the efficiency of Cellex-P for preconcentration of metal ions is not only similar to that of other chelating resins, but the kinetics of the ion-exchange process is better, so that high flow rates can be used to achieve rapid preconcentration of metal ions. (Doria-PTT)
W87-08019

DETERMINATION OF CADMIUM IN ENVIRONMENTAL MATERIALS BY FAST NEUTRON ACTIVATION ANALYSIS,
Ghent Rijksuniversiteit (Belgium). Inst. voor Nukleaire Wetenschappen.
M. Esprit, C. Vandecasteele, and J. Hoste.
Analytica Chimica Acta ACACAM, Vol. 185, p 307-313, July 31, 1986. 3 fig, 1 tab, 9 ref.

Descriptors: *Analytical methods, *Cadmium, *Neutron activation analysis, *Sample preparation, *Radiochemical analysis, Performance evaluation, Pollutant identification, Beryllium, Radioisotopes, Cadmium radioisotopes, Irradiation, Chloroform, Reagents, Standard deviation, Sludge, Radioactivity techniques.

Cadmium is determined by activation analysis with fast neutrons, obtained irradiation of a thick beryllium target with 14.5-MeV deuterons. Cadmium-111m, formed via the 112Cd(n,2n)111mCd and 111Cd(n,n')111mCd reactions, is separated by liquid-liquid extraction with zinc diethyldithiocarbamate in chloroform and measured with a Ge(Li) gamma-spectrometer. For low concentrations, cadmium is precipitated as cadmium ammonium phosphate after the extraction. NBS and BCR reference materials were analyzed: for concentrations between 3 and 500 micrograms/g, the relative standard deviation ranges from 5 to 3%. The results obtained for sewage sludge are compared with those obtained by reactor neutron activation analysis. Low results were obtained with the latter process, possibly because activation analysis is free from reagent blanks. It is concluded that the method permits an accurate and relatively rapid determination of cadmium. The chemical separation of 111mCd is applicable to different kinds of materials. Although the method is less sensitive than thermal neutron activation analysis, it is much faster. (Doria-PTT)
W87-08020

DIFFERENTIAL-PULSE ANODIC VOLTAMMETRIC DETERMINATION OF DISSOLVED AND ADSORBED PHOSPHATE IN TURBID NATURAL WATERS,
Hokkaido Univ., Hakodate (Japan). Dept. of Chemistry.
K. Matsunaga, I. Kudo, M. Yanada, and K. Hasebe.
Analytica Chimica Acta ACACAM, Vol. 185, p 355-358, July 1986. 2 fig, 1 tab, 5 ref.

Descriptors: *Analytical methods, *Voltammetry, *Anodes, *Phosphates, *Turbidity, *Suspended solids, *Adsorption, *Chemical analysis, Pollutant identification, Electrodes, Physical properties, Orthophosphates, Photometry, Spectrophotometry, Reagents, Estuaries, Water analysis.

It is difficult to measure phosphate concentrations accurately in turbid waters, and no method has been reported for determining both dissolved and adsorbed phosphate in natural waters. The applicability of the voltammetric method to natural waters was therefore examined, and adsorbed phosphate determined. In this method, the peak current is related to the reoxidation of the molybdophosphate complex at a glassy-carbon electrode. The reproducibility of the method was tested; the relative standard deviations for five determinations were 4.2% for 2.5 microM phosphate in sea water, and 5.1% for 1 microM phosphate in river water. Results obtained by voltammetry were compared with those obtained by spectrophotometry. When the absorbance of the suspended matter was below 0.01, all values were almost on a 1:1 line. When absorbance was above 0.01, the values obtained spectrophotometrically were significantly lower than those obtained by voltammetry. Phosphate concentrations measured by both methods in an estuary were plotted against salinity. Values obtained by voltammetry were on a dilution line, whereas those obtained spectrophotometrically were below the line, especially at low salinity. Results indicate that phosphate measured by spectrophotometry is in dissolved and adsorbed forms. (Doria-PTT)
W87-08021

TROPHIC INTERACTIONS BETWEEN HETEROTROPHIC PROTOZOA AND BACTERIOPLANKTON IN ESTUARINE WATER ANALYZED WITH SELECTIVE METABOLIC INHIBITORS,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2L.
W87-08026

PERIPHYTON AS MONITORS FOR HEAVY METAL POLLUTION IN THE CALCASIEU RIVER ESTUARY,
McNeese State Univ., Lake Charles, LA. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W87-08055

DERIVATIVES OF DICYCLOPENTADIENE IN GROUND WATER,
Johns Hopkins Univ., Baltimore, MD. School of Medicine.
R. B. van Breemen, C. C. Fenselau, R. J. Cotter, A. J. Curtis, and G. Connolly.
Biomedical and Environmental Mass Spectrometry, Vol. 14, p 97-102, 1987. 6 fig, 1 tab, 17 ref. PHS Grant GM 21248.

Descriptors: *Path of pollutants, *Dicyclopentadiene, *Groundwater pollution, *Analytical methods, *Gas chromatography, *Mass spectrometry, Organic compounds, Metabolites, Groundwater, Enzymes, Deuterium, Rocky Mountain Arsenal.

Dicyclopentadiene, a waste product of manufacturing at the Rocky Mountain Arsenal near Denver Colorado, has been detected in ground water at this facility. Ground water extracts were analyzed by gas chromatography-mass spectrometry (GC/MS) to determine if derivatives of dicyclopentadiene were present in addition to dicyclopentadiene and other chemical wastes. The derivatives thus identified were characterized by GC high resolution MS, deuterium exchange for active hydrogen in the chemical ionization source of the mass spectrometer, and GC/MS following on-column base catalyzed deuteration of enolizable hydrogen. Two ketone derivatives of dicyclopentadiene were identified by comparison with synthetic standards. Ground water derivatives of dicyclopentadiene were compared with mammalian enzymatic metabolites produced in vitro by incubation with immobilized rabbit liver cytochromes P-450. The metabolites were analyzed by GC/MS and by GC/MS following derivatization and deuterium labelling. Although not found in ground water samples, the two metabolites were identified as monoepoxides of dicyclopentadiene by comparison with compounds synthesized in the laboratory. (Author's abstract)
W87-08063

IDENTIFICATION AND QUANTIFICATION OF ARSENOCHOLINE AND ACETYLARSENOCHOLINE IN TRACE AMOUNTS IN BIOLOGICAL MATERIAL BY USE OF PYROLYSIS GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
National Inst. of Environmental Medicine, Stockholm (Sweden).
H. Norin, A. Christakopoulos, L. Rondahl, A. Hagman, and S. Jacobsson.
Biomedical and Environmental Mass Spectrometry, Vol. 14, p 117-125, 1987. 7 fig, 1 tab, 28 ref. Swedish Environmental Protection Board Grant 5311064-9.

Descriptors: *Pollutant identification, *Analytical methods, *Measuring instruments, *Arsenocholine, *Acetylarsenocholine, *Gas chromatography, *Mass spectrometry, Aquatic animals, Fish, Tissue analysis, Degradation, Deuterium.

An analytical method, based on a selective extraction and pyrolysis gas chromatography/mass spectrometry assay of arsenocholine and acetylarsenocholine in aquatic organisms, is described. Characteristic fragmentation patterns were obtained from pyrolytically demethylated compounds. The molecules were rearranged in unique pathways which differed from those of corresponding nitrogen analogues. Qualitative determination of arsenocholine and acetylarsenocholine was achieved by gas chromatographic as well as mass spectrometric analysis of the thermal degradation products (trimethylarsine, dimethylvinylarsine and the demethylated arsenocholine or acetylarsenocholine). Arsenocholine and acetylarsenocholine in fish from industrially polluted water were isolated and identified. Mass fragmentographic quantification of the arsenic compounds in fish was carried out by use of deuterium labelled analogues of arsenocholine and acetylarsenocholine as internal standards. The method showed a high sensitivity. (Author's abstract)
W87-08064

GROUND-WATER CONCENTRATIONS OF 226RA AND 222RN IN NORTH CAROLINA PHOSPHATE LANDS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W87-08069

AUTOMATED PROCEDURE FOR MONITORING THE EFFECTIVENESS OF OZONATION PROCESSES,
Centre de Recherche Lyonnaise des Eaux - Degremont, Le Pecq (France).
For primary bibliographic entry see Field 5F.
W87-08072

DETERMINATION OF TIN IN SEDIMENTS AND SEWAGE SLUDGES BY ATOMIC AB-

SORPTION SPECTROMETRY WITH HYDRIDE GENERATION (DETERMINATION DE L'ETAIN DANS LES SEDIMENTS ET LES BOUES DESTATIONS D'EPURATION PAR SPECTRMETRIE D'ABSORPTION ATOMIQUE AVEC GENERATION D'HYDRURES),
Laboratoire Central des Ponts et Chaussees, Bouguenais (France).
For primary bibliographic entry see Field 7B.
W87-08082

INTERFERENCES IN THE DETERMINATION OF COPPER IN NATURAL WATERS BY ANODIC STRIPPING VOLTAMMETRY,
Commonwealth Scientific and Industrial Research Organization, Sutherland (Australia). Div. of Energy Chemistry.
For primary bibliographic entry see Field 7B.
W87-08083

ANALYSIS OF RESIDUAL BROMINE IN WATER IN THE PRESENCE OF AMMONIA NITROGEN BY THE DPD METHOD,
Laboratoire d'Hydrologie, Paris (France). Faculte des Sciences Pharmaceutique et Biologique.
N. Strupler.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 41, No. 1, p 75-80, February 1987. 2 tab, 21 ref.

Descriptors: *Bromine, *Analytical methods, *Residual bromine, *Disinfection, *Ammonia, *DPD method, Estimating, Titrations, Sample preparation, Bromine, Iodine, Nitrogen, Colorimetry.

The problem of analyzing residual bromine arises directly from its use as a disinfectant in natural water swimming pools or indirectly when chlorination is applied in the presence of bromide as in sea water swimming pools, in aquaculture and in cooling systems. Where free bromine is concerned, the DPD titrimetric, colorimetric and visual comparator field test methods gave very good results agreeing with those of the acid iodometric method. Combined bromine in the form of mono and dibromamine (NH2Br, NHBr2) responds with DPD in the same manner as free bromine, that is, completely, without the need for addition of iodide. Tribromamine gives a partial response of the order of 70 per cent. It is necessary to add a small quantity of iodide (one crystal) to obtain a complete response. For mixtures of free bromine and combined bromine, the supplementary nitrite procedure permits an estimation to be made of the three different fractions, free bromine, mono plus dibromamine, and tribromamine. (Alexander-PTT)
W87-08090

ENVIRONMENTAL EFFECTS ON LASER-INDUCED FLUORESCENCE SPECTRA OF NATURAL WATERS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 7B.
W87-08104

EFFECT OF INORGANIC PARTICULATES ON THE ASV SIGNALS OF CD, PB AND CU,
Newcastle Univ. (Australia). Dept. of Chemistry.
T. U. Aualiitia, and W. F. Pickering.
Talanta TLNTA2, Vol. 34, No. 2, p 231-237, February 1987. 5 fig, 1 tab, 26 ref.

Descriptors: *Water analysis, *Chemical interference, *Interference, *Measuring instruments, *Inorganic particulates, *Voltammetry, *Analytical methods, *Cadmium, *Copper, *Lead, *Heavy metals, *Electrodes, Sediments, Metal oxides, Metals, Ions, Complexation, Buffers, Sample preparation, Membranes.

The potential influence of inorganic particulates on the anodic stripping voltammetry (ASV) response of <100microgram/l. levels of Cd, Pb and Cu, at a thin film mercury electrode, was examined by adding various weights of the solids to the acetate background electrolyte solution. Materials added included the hydrous oxides of Mn(IV), Fe(III) or Al(III), clay minerals (kaolinite, illite, montmorillonite) and some contaminated sediments. Abrasion of the mercury film was minimized by deaerating the turbid solutions before their transfer to the measuring cell. The hydrous oxides specifically sorbed all three metal ions, resulting in peak-size changes that varied in magnitude with pH. With the clays, only sorption of Pb by illite or montmorillonite was detected. The presence of the solids had little effect on the peak position or half-peak breadth of the Cd or Pb signals, but the Cu peak parameters changed, indicating some hydroxy-species formation at higher pH. Some contaminated sediment samples released a significant fraction of their total metal content into acetate buffer solutions. Shielding the mercury film with a semipermeable membrane had a similar effect to filtering the suspension before analysis, but diffusion equilibrium was only slowly achieved (>12 hr). (Author's abstract)
W87-08131

MODIFIED SCHEME FOR IDENTIFICATION OF COLIFORM ORGANISMS IN DRINKING WATER,
All-India Inst. of Hygiene and Public Health, Calcutta. Dept. of Microbiology.
D. Chattopadhya, and S. Basu.
Indian Journal of Medical Research IJMRAQ, Vol. 83, No. 2, p 152-154, February 1986. 1 tab, 8 ref.

Descriptors: *Pollutant identification, *Analytical methods, *Coliforms, *Drinking water, Isolation, Species composition, Performance evaluation.

A total of 370 coliform strains isolated from 950 drinking water samples were typed and characterized on the basis of 32 tests. Most of the types as per the scheme of Wilson et al (1935) contained organisms belonging to more than one species or even genus, some of which were quite unrelated having different GC contents. To overcome this limitation, the scheme of Wilson et al has been modified in this study by replacing the gelatin liquefaction test with the motility test. Using the new scheme most of the coliform organisms could be identified up to species level in much less time. (Author's abstract)
W87-08134

TESTING METHODS FOR HAZARDOUS WASTES PRIOR TO LANDFILL DISPOSAL,
UKAEA Atomic Energy Research Establishment, Harwell (England). Waste Research Unit.
For primary bibliographic entry see Field 5E.
W87-08172

CASE STUDIES IN INDUSTRIAL WASTE CHARACTERIZATION,
California Dept. of Health Services, Berkeley. Hazardous Materials Lab. Section.
B. P. Simmons, and R. D. Stephens.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 97-104, 1 fig, 4 tab, 3 ref.

Descriptors: *Case studies, *Industrial wastes, *Waste characterization, *Sludge, Pollutant identification, Gas chromatography, Mass spectrometry, Sulfuric acid, Municipal wastes, Tetrahydrothiophene.

A scheme has been developed for characterizing industrial wastes: (1) background information search, including a review of the appropriate industrial processes and a review of pertinent physical, chemical, and biochemical reactions that may have affected the composition of the waste; (2) initial sampling and analysis, using such techniques as gas chromatography/mass spectrometry, X-ray fluorescene, in addition to screening tests for hazard assessment; (3) review of initial data and design of the comprehensive characterization; (4) detailed sampling and analysis, including a detailed safety plan; and (5) interpretation of results for legal purposes, health risk assessment, and environmental impact assessment. A sample case history of an abandoned acid petroleum sludge site is given to illustrate this characterization process. Although the general approach to characterization is the same, each waste presents particular problems. These problems are discussed, with emphasis on the chemical and physical reactions that complicate the problem of adequate characterization. The goal in any problem is the same: to provide a characterization that is adequate for health assessment, legal interpretation of environmental assessment, or mitigation design. The results are generally consistent with the identification of the waste as a refinery sulfuric acid sludge. Large amounts of sulfur dioxide and volatile hydrocarbons are contained in the sludge. Initial indications are that the material has not spread laterally to a great extent. Arsenic in high concentrations is distributed on the surface of one sump. Tetrahydrothiophene (THT) and substituted tetrahydrothiophenes have been found in significant levels. Because THT has an odor threshold of 0.5 ppb, it presents potential nuisance and health effects considerations. Work is now under way to determine the existing and potential vectors for movement of the identified waste components and to quantitate the existing and potential environmental and health effects. (See also W87-08166) (Lantz-PTT)
W87-08174

MAMMALIAN MITOCHONDRIA AS IN VITRO MONITORS OF WATER QUALITY,
Wisconsin Univ.-Madison. Water Resources Center.
G. A. Blondin, L. M. Knobeloch, H. W. Read, and J. M. Harkin.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 467-474, March 1987. 2 fig, 1 tab, 14 ref.

Descriptors: *Mitochondria, *Bioindicators, *Water pollution effects, *Reverse electron transfer, *Toxicity, *Bioassay, *Water quality, Biological properties, Mammals, Monitoring.

Degradation of surface and groundwater quality has stimulated rigorous efforts to develop reliable biological methods for quantifying aquatic toxicity. Most methods have focused on the use of fish or aquatic invertebrates to assess risk to humans and other species posed by chemical pollutants in water. Most of these tests are too expensive and time consuming to provide affordable water quality surveillance programs on an extensive scale (e.g. fish acute toxicity tests cost about $700 each and require 48-96 h to determine median lethal concentrations of test substances). Rapid and inexpensive, yet reliable and sensitive, tests to monitor microcontaminant trends in water quality are needed to determine the toxicity of complex effluents discharged into aquatic systems. To measure acute toxicity effectively, a system must provide a simple, sensitive, and rapid measurement of physiological parameters which are indicative of overall organism (bacteria) or organelle (mitochondria) viability. To detect a broad spectrum of toxicants, the parameters should be associated with a major metabolic process controlled by independent enzyme systems. This study describes how phosphorylating submitochondrial particles (SMP), prepared by sonic disruption of the heavy fraction of bovine heart mitochondria, serve as in vitro indicators of aquatic toxicity. The bioassay is based on energy-coupled reverse electron transfer (RET) which permits rapid, simple and sensitive measurement of acute toxicity by spectrophotometric recording of the rate of NAD+ reduction. RET responses are easily quantifiable and the energy-coupled reaction is competent in reconstituted freeze-dried SMP. Thus a stable biological preparation, SMP, can be distributed to other laboratories. SMP response to 27 chemicals was tested; replicates deviated from the mean by about 13%. The SMP-based RET test has several advantages over whole organism testing: reduced capital and operating costs; rapidity and simplicity of testing procedures; ease of interpretation; and cost - about $2 per test to supply all necessary freeze dried biochemicals and incubation media components as test-ready materials. (McFarlane-PTT)
W87-08260

ARSENIC TOXICITY CHANGES IN THE PRESENCE OF SEDIMENT,

Texas Univ. at Dallas, Richardson. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5C.
W87-08263

SIZE AND MERCURY CONCENTRATION RELATIONSHIP AS CONTAMINATION INDEX,
Cordoba Univ. (Spain). Dept. de Higiene.
For primary bibliographic entry see Field 5B.
W87-08265

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHS) IN FISH FROM THE ARABIAN GULF,
Basrah Univ. (Iraq). Marine Science Centre.
For primary bibliographic entry see Field 5B.
W87-08270

EVALUATION OF MICROEXTRACTION/CAPILLARY COLUMN GAS CHROMOTOGRAPHY FOR MONITORING INDUSTRIAL OUTFALLS,
Occidental Chemical Corp., Grand Island, NY. Research Center.
D. R. Thielen, G. Olsen, A. Davis, E. Bajor, and J. Stefanovski.
Journal of Chromatographic Science JCHSBZ, Vol. 25, No. 1, p 12-16, January 1987. 1 fig, 3 tab, 7 ref, append.

Descriptors: *Microextraction, *Analytical methods, *Outfall sewers, *Monitoring, *Measuring instruments, *Gas chromatography, *Chemical analysis, Organic compounds, Wastewater disposal, Water pollution control, Pollutants, Pollutant identification, Performance evaluation, Waste disposal, Sample preparation, Industrial wastewater.

Microextractors and capillary-column gas chromatography techniques are applied to plant discharge streams for repetitive wastewater discharge permit analyses. This combination allows the analyst to reduce sample preparation since microextraction replaces both purge-and-trap for volatiles and microextraction for semi-volatiles. An additional advantage is the elimination of a concentration step, which is often a major contributor to low method recoveries. The overall procedure is shown to be more precise than purge-and-trap but slightly less precise than conventional extraction. The results of each method are equivalent. (Author's abstract)
W87-08272

IDENTIFICATION OF CRYPTOSPORIDIUM OOCYSTS IN RIVER WATER,
Washington Univ., Seattle. Dept. of Environmental Health.
J. E. Ongerth, and H. H. Stibbs.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 672-676, April 1987. 3 fig, 1 tab, 35 ref. EPA Contract 4C285NCSE.

Descriptors: *Parasites, *Pollutant identification, *Rivers, *Water analysis, *Oocysts, *Cryptosporidium, Isolation, Ultrafiltration, Detection limits, Diseases, Distribution.

Water samples were collected from four rivers in Washington State and two rivers in California and examined for the presence of Cryptosporidium oocysts. Oocyst-sized particles were concentrated from 20-liter samples of water by membrane filtration, centrifugation, and differential sedimentation. The particle concentrate was then deposited on a 25-mm-diameter membrane filter for oocyst identification by indirect immunofluorescence assay. The identification procedure had a limit of detection of about five oocysts per liter. Cryptosporidium oocysts were found in each of 11 river water samples examined. Concentrations ranged from 2 to 112 oocysts per liter. The finding of Cryptosporidium oocysts in all samples examined from six western rivers is noteworthy in light of recent reports indicating that Cryptosporidium sp. is a significant agent of human and animal disease. This finding suggests that waterborne oocysts of this parasite are more important than was previously recognized. More detailed studies are needed to define geographical and temporal distribution, to assess the viability of waterborne oocysts, and to determine the importance of water as a means of transmission. (Author's abstract)
W87-08290

DETECTION OF CRYPTOSPORIDIUM IN WATER BY USING POLYPROPYLENE CARTRIDGE FILTERS,
Arizona Univ., Tucson. Dept. of Microbiology and Immunology.
C. E. Musial, M. J. Arrowood, C. R. Sterling, and C. P. Gerba.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 687-692, April 1987. 1 fig, 7 tab, 20 ref.

Descriptors: *Oocysts, *Cartridge filters, *Analytical methods, *Pollutant identification, *Cryptosporidium, *Parasites, *Sample preparation, Public health, Diseases, Filters, Flow rate.

Members of the genus Cryptosporidium are protozoan parasites that cause gastroenteritis in humans and animals and appear to be spread largely by the fecal-oral route. A method was developed for the concentration and detection of Cryptosporidium oocysts in water to assess their occurrence in the environment and potential for waterborne disease transmission. This method was developed by using spun polypropylene cartridge filters. Optimal conditions for concentration, filter elution, filter porosity, and detection were determined. Fluoresceinated monoclonal antibodies were used for oocyst detection. Experiments also were conducted to study the effect of flow rate, low oocyst numbers, and the addition of detergents on recovery and retention of oocysts. The method that was developed was sensitive enough to detect oocysts at levels of less than 1 per liter. Using this method, Cryptosporidium oocysts were isolated from secondarily treated sewage. (Author's abstract)
W87-08291

COMPARISON OF METHODS FOR ROTAVIRUS DETECTION IN WATER AND RESULTS OF A SURVEY OF JERUSALEM WASTEWATER,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
N. Guttman-Bass, Y. Tchorsh, and E. Marva.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 761-767, April 1987. 12 tab, 23 ref.

Descriptors: *Analytical methods, *Comparison studies, *Rotaviruses, *Wastewater, Surveys, Jerusalem, ELISA, Enzymes, Cytotoxicity, Detection limits, Viruses.

Methods for the detection of viable rotaviruses and rotavirus antigen in water were developed and compared. The methods included laboratory-developed enzyme-linked immunosorbent assays (ELISAs) with chromogenic and luminescent substrates, commercial Rotazyme and Enzygnost ELISAs, and an indirect immunofluorescent assay. Of the methods tested, the immunofluorescent assay and the Enzygnost ELISA were the most sensitive for the simian rotavirus SA-11. All of the methods were positive for human rotavirus from clinical specimens. Seeded SA-11 rotavirus was concentrated from water by adsorption to and elution from Zeta Plus filters followed by organic flocculation. Interference with the assays by components of the wastewater concentrates was minimal for the ELISAs, although the undiluted organic flocs were cytotoxic for the immunofluorescent assay. A survey of Jerusalem wastewater was carried out over the course of 1 year, and samples were assayed for rotaviruses and enteroviruses. Although enteroviruses were found in almost all of the samples, all samples were negative for rotaviruses. The concentration of rotaviruses in the wastewater was thus below the detection limit of the methods used. (Author's abstract)
W87-08295

NEW SELECTIVE MEDIUM FOR ISOLATING PSEUDOMONAS SPP. FROM WATER,
Stuart Pharmaceuticals, Wilmington, DE.
C. L. Krueger, and W. Sheikh.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 895-897, April 1987. 3 tab, 7 ref.

Descriptors: *Analytical method, *Culturing media, *Isolation, *Pseudomonas, Nutrients, Agar, Nitrofurantoin, Crystal violet, Selectivity, Cultures.

A new medium, pseudomonas selective isolation agar, was developed to isolate Pseudomonas spp. from water. It consists of 350 microgram(ug) of nitrofurantoin per ml and 2 ug of crystal violet per ml in a nutrient agar base. It is more selective for Pseudomonas spp. than are available commercial media. Its ingredients are inexpensive and readily available, and it is easy to prepare. (Author's abstract)
W87-08300

ROLE OF RESEARCH MEASUREMENT NETWORKS AS CONTRIBUTORS TO FEDERAL ASSESSMENTS OF ACID DEPOSITION,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 7A.
W87-08314

SUBMICRON SIZE DISTRIBUTIONS OF INORGANIC SUSPENDED SOLIDS IN TURBID WATERS BY PHOTON CORRELATION SPECTROSCOPY,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
For primary bibliographic entry see Field 7B.
W87-08336

ANALYTICAL METHODS IN APPLIED ENVIRONMENTAL GEOCHEMISTRY,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
M. Thompson.
IN: Applied Environmental Geochemistry, Academic Press, London. 1983. p 75-101, 6 fig, 1 tab, 35 ref.

Descriptors: *Pollutant identification, *Water analysis, *Chemical analysis, Geochemistry, Sample preparation, Metals, Heavy metals, Atomic absorption spectroscopy, Quality control, Soil analysis.

Analysis of geochemical samples has traditionally used methods with a high rate of throughput and low unit cost. Most samples are solid and require decomposition and liberation of the analyte into solution. Most sample decomposition is carried out in borosilicate or polytetrafluorethylene laboratory ware. Metal heating blocks containing up to 200 sample tubes are used to heat samples to about 175 degrees C. Analytical-grade reagents are usable for samples in which analyte concentrations are reasonably high; higher purity reagents and deionized or distilled water are used for trace metal analysis. Methods are described for mechanical reduction of rocks, soils and sediments, and herbage. Strong acids available for decomposition of samples include hydrofluoric, perchloric-nitric, nitric, hydrochloric, and aqua regia. Vegetation can be decomposed with nitric acid-perchloric acid mixture (if non-fatty) or dry ashing. Selective extractants include 0.5M acetic acid, ammonium acetate, EDTA diammonium salt, and neutral ammonium acetate with reducing agent. Preconcentration is necessary for trace levels to be determined in water. The most widely used analytical method for environmental geochemistry is atomic absorption analysis with nebulization into a flame. A rapidly spreading method is inductively coupled plasma atomic emission spectrometry. (See also W87-08353) (Cassar-PTT)
W87-08356

RESERVOIR WATER QUALITY DATA COLLECTION,
Army Engineer District, Wilmington, NC.
For primary bibliographic entry see Field 7B.
W87-08369

WATER QUALITY LABORATORY ANALYSIS,

Corps of Engineers, Waltham, MA. New England Div.
R. J. D. Duono.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 49-53.

Descriptors: *Chemical analysis, *Water analysis, *Laboratories, Water resources development, Water quality, Resource management, Water sampling, Aquatic environment.

The need for users of analytical laboratories to coordinate with the laboratory from planning the data collection program to samples analyses is discussed. Only through such careful coordination can the user receive valid data that is representative of the water body being studied. Constraints to planning a data collection program are outlined for both in-house and contract laboratories. An example data collection program is presented, along with references for guidelines and standard methods. Finally, the control of the laboratory analysis program is discussed. Of principal importance to the user of laboratory services is the assurance that quality control is being exercised throughout the program. Steps to achieve quality control are outlined. (See also W87-08365) (Halterman-PTT)
W87-08370

LABORATORY ANALYSES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. B. Strong.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 76-82, 1 tab, 3 ref.

Descriptors: *Laboratories, *Chemical analysis, *Water analysis, *Water resources development, Water management, Water quality, Water sampling, Environmental effects, Regulations, Data collection.

Various aspects of the laboratory analysis of samples generated in water quality projects are presented. The increasing importance of obtaining efficient laboratory services, either from in-house or contract laboratories, due to the severe restrictions being placed on the Civil Works budget, is discussed. Several considerations that should be made in preparing a scope of work or contract for chemical analyses are outlined. They are selection of analytical techniques, reporting of specifications, cost, quality control, and laboratory or contractor selection. The use of laboratory analyses to provide data for meeting analytical requirements specified in state or federal regulations, or to support research activities, is discussed, and the need for quality data, whatever the purpose, is stressed. (See also W87-08365) (Halterman-PTT)
W87-08373

HAZARD ASSESSMENT OF CHEMICAL: CURRENT DEVELOPMENTS, VOLUME 1.
Academic Press, New York. 1981. 461 p. Edited by Jitendra Saxena and Farley Fisher.

Descriptors: *Environmental effects, *Pollutant identification, *Water pollution effects, *Ecological effects, *Hazardous materials, Heavy metals, Trace elements, Separation techniques, Toxins, Bioassays, Reviews, Metals, Aromatic compounds, Aquatic animals.

This annual serial publication is intended to present comprehensive and authoritative reviews of new and significant developments in the area of hazard assessment of chemicals. Each volume, in addition to subject reviews contains case histories of topical chemicals and/or chemical classes. This first volume contains three chapters which deal with environmental and health effects of chemicals. Other chapters deal with in vitro mammalian metabolic systems and their utility in in vitro bioassays, and the prediction of metabolic transformations and mutagenic and carcinogenic potential of chemicals based on structural and physical parameters. Another chapter summarizes test procedures used for evaluating effects of xenobiotics on the reproduction of aquatic organisms along with reported effects of selected inorganic and organic toxicants. A chapter on azaarenes gives data on their environmental sources, levels and toxicological and carcinogenic activity. (See also W87-08395 thru W87-08400) (Geiger-PTT)
W87-08394

PRECONCENTRATION OF TRACE METALS FROM AQUATIC ENVIRONMENTAL SAMPLES,
Manitoba Univ., Winnipeg. Dept. of Chemistry.
A. Chow, and H. D. Gesser.
IN: Hazard Assessment of Chemicals: Current Developments, Vol. 1, Academic Press, New York. 1981. p 17-57, 516 ref.

Descriptors: *Pollutant identification, *Separation techniques, *Metals, *Trace metals, Chromatography, Freezing, Heavy metals, Adsorption, Absorption, Ion exchange, Sorption, Evaporation, Electrochemistry, Reverse osmosis, Thin layer chromatography, Chemical precipitation, Biological magnification.

Some methods that have appeared in the literature for preconcentration of priority pollution trace metals found in the aquatic environment are described. Hydroxides are easily produced and very flocculant inorganic coprecipitants of metals. They remove both ionic and nonionic species from solution. Sulfur and several sulfides remove Hg, Ag, As, Co and Zn. Numerous inorganic materials may be used to precipitate or collect trace metals from solution. Organic coprecipitants are less soluble and more selective than inorganic reagents. Diethyldithiocarbamate is widely used to remove As, Se, Cr, Pb and Fe. The preconcentration of trace metals by electrodeposition is an integral part of anodic-stripping voltammetry. Evaporation methods include both the removal or reduction in volume of the aqueous matrix plus removal of particular elements by the formation of volatile species. Freezing is used mostly for desalination and preconcentration of radioactive wastes; trace metal recovery by freezing techniques has been relatively inefficient. Sorption methods include adsorption, absorption, ion exchange, and combinations of these. Solvent extraction is one of the most powerful methods of preconcentration of trace metals from aqueous systems. Miscellaneous methods of trace metal isolation or preconcentration include fire-assays, paper and thin-layer chromatography, bioconcentration systems, and reverse osmosis. (See also W87-08394) (Geiger-PTT)
W87-08396

CHLORINATED DIOXINS AND DIBENZOFURANS IN PERSPECTIVE.
Lewis Publishers, Inc., Chelsea, MI. 1986. 570 p. Edited by Christoffer Rappe, Gangadhar Choudhary, and Lawrence H. Keith.

Descriptors: *Dioxins, *Pollutant identification, *Fate of pollutants, *Path of pollutants, *Waste disposal, Hazardous materials, Toxins, Chlorinated hydrocarbons, Decontamination, Detoxification.

The detection, measurement and destruction of hazardous chlorinated dioxins and dibenzofurans, especially 2,3,7,8-tetrachlorodibenzo-p-dioxin, in soils and industrial waste products is discussed. The continuing problems of sampling, analysis, and fate of these compounds in soils and related matrices are also discussed. Newly developed analytical techniques and cleanup techniques are described. (See also W87-08472 through W87-08492) (Wood-PTT)
W87-08471

DEVELOPMENT OF HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC METHODS FOR SEPARATION AND AUTOMATED COLLECTION OF TETRACHLORODIBENZO-P-DIOXIN ISOMERS,
Wright State Univ., Dayton, OH. Brehm Lab.
D. Wagel, T. O. Tiernan, M. L. Taylor, B. Ramalingam, and J. H. Garrett.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 305-327, 14 fig, 4 tab, 6 ref. EPA Cooperative agreement CR-809972-01-1.

Descriptors: *Analytical methods, *Automation, *High performance liquid chromatography, *Pollutant identification, *Separation techniques, *Dioxin, Data acquisition, Chemical isomers, Chromatography, Optimization, Chlorinated hydrocarbons.

Investigations of the properties of the 22 tetrachlorodibenzo-p-dioxin (TCDD) isomers have been hampered by the availability of only limited quantities of the individual isomers. As part of a continuing project to prepare larger quantities of these compounds, new high performance liquid chromatographic (HPLC) procedures were developed to isolate individual TCDD isomers from synthetic mixtures. By carefully adjusting the chromatographic parameters, more stable and efficient reversed-phase HPLC (RP-HPLC) and normal-phase HPLC (NP-HPLC) methods were developed and employed to separate components of seven synthetic mixtures of the TCDD isomers. The procedures were developed empirically by evaluating various RP-HPLC separation conditions and developing optimum mobile phases to separate the mixtures. The automated collection of HPLC fractions was easily implemented because the retention time stability and peak shape obtained with the specialized HPLC mobile phases were superior to those observed under normal-phase conditions. The improved resolution of the RP-HPLC procedures also permitted overloading of the columns and the collection of the broadened peaks without cross-contamination, facilitating more rapid separation and collection of larger quantities of the pure TCDD isomers. (See also W87-08471) (Wood-PTT)
W87-08480

EVALUATION OF XAD-2 RESIN CARTRIDGE FOR CONCENTRATION/ISOLATION OF CHLORINATED DIBENZO-P-DIOXINS AND FURANS FROM DRINKING WATER AT THE PARTS-PER-QUADRILLION LEVEL,
Health and Welfare Canada, Ottawa (Ontario).
G. L. LeBel, D. T. Williams, J. J. Ryan, and B. P.-Y. Lau.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 329-341, 5 fig, 5 tab, 13 ref.

Descriptors: *Analytical methods, *Ion exchange, *Gas liquid chromatography, *Pollutant identification, *Drinking water, *Separation techniques, *Amberlite XAD-2 resin, Data acquisition, Resins, Adsorbents, Dioxin, Dibenzofuran, Chlorinated hydrocarbons, Trace levels.

Because of the toxicity and persistence of some isomers of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), methods for the analysis of PCDD and PCDF at the parts-per-quadrillion (pg/L) level in water were developed. Analysis at these extremely low levels requires large sample size, sensitive/selective detectors and/or very clean extracts. Methods involving the adsorbent Amberlite XAD-2 resin have previously only been used to for compounds present at nanogram or microgram/L levels in water. The results of the evaluation of its potential for the extraction and analysis of pg/L PCDD and PCDF in drinking water were presented. The XAD-2 resin technique was effective in the extraction/concentration of PCDD and PCDF at levels down to 1 pg/L and permitted sampling of large volumes (200 L) of water without tedious extraction with large volumes of solvent. (See also W87-08471) (Wood-PTT)
W87-08481

MEASUREMENT OF PCDD-PCDF FROM INCINERATOR AND PCP SAMPLES,
Department of the Environment, Ottawa (Ontario). River Road Environmental Technology Center.
R. C. Lao, R. S. Thomas, C. Chiu, R. Halman, and K. Li.

IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 343-353, 4 fig, 7 tab, 9 ref.

Descriptors: *Pollutant identification, *Polychlorinated hydrocarbons, *Analytical methods, *Incineration, *Waste disposal, *Pollutants, Dioxin, Dibenzofurans, Canada, Municipal wastes.

As part of the assessment program for combustion sources of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), the amounts of these contaminants were measured in the emissions from typical municipal incinerators in Canada. The application of a protocol for determination of PCDD/PCDF present in the gaseous phase and that which is adsorbed on particulate matter was described. (See also W87-08471) (Wood-PTT)
W87-08482

DIOXIN RESIDUES IN FISH AND OTHER FOODS,
Food and Drug Administration, Rockville, MD.
For primary bibliographic entry see Field 5B.
W87-08483

COMPARISON OF A NEW RAPID EXTRACTION GC/MS/MS AND THE CONTRACT LABORATORY PROGRAM GC/MS METHODOLOGIES FOR THE ANALYSIS OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN,
Satterthwaite Associates, Inc., West Chester, PA.
J. S. Smith, D. B. Hur, M. J. Urban, R. D. Kleopfer, and C. J. Kirchmer.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 367-380, 1 fig, 8 tab, 3 ref.

Descriptors: *Analytical methods, *Pollutant identification, *Gas chromatography, *Dioxin, *Sample analysis, *Comparison studies, Data acquisition, Chromatography, Mass spectrometry, Field tests, Polychlorinated hydrocarbons, Cleanup.

A new method us given for rapid 2,3,7,8-tetrachloro-p-dibenzodioxin (TCDD) analysis that can be performed in the field, and yields results analogous to the conventional GC/MS EPA methods. QA/QC criteria was developed on the basis of which it was determined whether or not the result of any given analysis was acceptable or if sample cleanup was needed. Eight samples, each in six replicates, were analyzed by both the comparatively new GC/MS/MS method and the conventional GC/MS technique. The samples for GC/MS/MS analysis were run without cleanup, after one stage of cleanup, and after two stages of cleanup. The sample consisted of five Missouri soils, one New Jersey soil, and two synthetic Potter's clay mixtures impregnated with TCDD. It was demonstrated that the fast GC/MS/MS method produces results with the accuracy and precision of the more cumbersome and time-consuming GC/MS method. (See also W87-08471) (Wood-PTT)
W87-08484

SOME ANALYTICAL CONSIDERATIONS RELATING TO THE DEVELOPMENT OF A HIGH-RESOLUTION MASS SPECTROMETRIC DIOXIN ANALYTICAL PROTOCOL,
New York State Dept. of Health, Albany. Wadsworth Center for Labs. and Research.
J. R. Donnelly, G. W. Sovocool, Y. Tondeur, S. Billets, and R. K. Mitchum.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 381-398, 4 fig, 2 tab, 45 ref. EPA Contracts 68-03-3050 and 68-03-3294; EPA Cooperative agreement CR-809706-01.

Descriptors: *Pollutant identification, *Mass spectrometry, *Dioxin, *Analytical methods, Trace levels, Soil contamination, Sediments, Water pollution, Data acquisition, Chlorinated hydrocarbons.

Efforts to incorporate proven analytical principles while providing state-of-the-art methodology suitable for detection of dioxins for parts-per-trillion level determinations in soil, sediment, and water matrices are described. Known methods were validated and evaluated individually. Where possible, innovative thinking was used to provide rugged methodology which would afford very high-quality data. Adaptation of known analytical methods to include high-resolution mass spectrometry was explored in detail. Current EPA plans are to use this method in a contractual situation. (See also W87-08471) (Wood-PTT)
W87-08485

EVALUATION OF RCRA METHOD 8280 FOR ANALYSIS OF DIOXINS AND DIBENZOFURANS,
Lockheed-EMSCO, Las Vegas, NV.
J. R. Donnelly, T. L. Vonnahme, C. M. Hedin, and W. J. Niederhut.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 399-435, 5 fig, 17 tab, 23 ref, append. EPA Contracts 68-03-3050 and 68-03-3249.

Descriptors: *Pollutant identification, *RCRA Method 8280, *Dioxin, *Analytical methods, Dibenzofurans, Chlorinated hydrocarbons, Mass spectrometry, Gas chromatography, Cleanup, Chromatography, Performance evaluation, Soil contamination.

Major revisions were made to the published RCRA Method 8280 for analysis of dioxins and dibenzofurans including: (1) substitution of correct m/z values so that the mass spectrometer could detect analytes and standards introduced via the interfaced gas chromatograph; (2) revision of the extract cleanup on an alumina column so that all desired analytes eluted in a single fraction with most of the analytical interferences removed; (3) elaboration of the method so that wet samples could be accommodated; and (4) development of HPLC procedures that could be reproducibly and effectively performed. The revised method was subjected to performance tests which involved analysis of reference materials containing 2,3,7,8-tetrachlorodibenzo-p-dioxin and interferences, and precision and accuracy determinations on samples with known composition through spiking in the laboratory. With the revisions, satisfactory method performance was demonstrated on soil-type samples. (See also W87-08471) (Wood-PTT)
W87-08486

APPROACHES TO THE DETERMINATION OF LIMIT OF DETECTION IN 2,3,7,8-TCDD ANALYSES,
Weston (Roy F.), Inc., Kansas City, KS.
C. J. Kirchmer, T. S. Viswanathan, and R. D. Kleopfer.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 437-452, 4 fig, 2 tab, 10 ref.

Descriptors: *Pollutant identification, *Detection limits, *Dioxin, *Gas chromatography, *Mass spectrometry, Data acquisition, Analytical methods, Chromatography, Calibrations, Mathematical equations.

Procedures for calibration and analysis of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) by isotope dilution gas chromatography/mass spectrometry (IDMS) are reviewed. Recommendations regarding the best procedure to follow in establishing the limit of detection for 2,3,7,8-TCDD analyses were made using a flow chart. Since the required limit of detection (LOD) is an important factor in selecting an analysis method, definition of the required LOD based on data needs is crucial. Appropriate equations for calculation, recommendations and arguments were presented. (See also W87-08471) (Wood-PTT)
W87-08487

CHARACTERIZATION OF POLYCHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURANS BY POWDER X-RAY DIFFRACTION,
Miami Univ., Oxford, OH. Dept. of Chemistry.
J. S. Cantrell, P. J. Slonecker, and T. A. Beiter.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 453-466, 5 fig, 7 tab, 7 ref.

Descriptors: *Analytical methods, *Pollutant identifications, *X-ray diffraction, *Dioxins, *Dibenzofurans, *Standards, Chlorinated hydrocarbons, Gas chromatography, Mass spectrometry, Calorimetry, Molecular structure.

A set of powder X-ray diffraction patterns of well characterized polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) is presented. They were determined in order to provide analytical 'fingerprints' for cases in which suspect PCDD or PCDF standards need to be validated in their isometric assignment, for the analysis of unknown PCDD and PCDF mixtures, and for use in laboratories without available standards. The sixteen samples of PCDDs and PCDFs were carefully characterized by EC/GC, GC/MS, and differential scanning calorimetry to establish their purity and verify their chlorine substitution patterns before the powder X-ray diffraction patterns were tabulated. (See also W87-08471) (Wood-PTT)
W87-08488

X-RAY PHOTOCONDUCTIVITY MEASUREMENTS OF EXAFS IN LIQUIDS: TECHNIQUES AND APPLICATIONS,
Brookhaven National Lab., Upton, NY. Chemistry Dept.
T. K. Sham, and R. A. Holroyd.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-014566. Price codes: A10 in paper copy, A01 in microfiche. Report No. BNL--35019, (1984). 3 p, 3 fig, 5 ref. DOE Contract DE-AC02-76CH00016.

Descriptors: *Analytical methods, *X-ray photoconductivity, *Data acquisition, *Photoconductivity measurements, *Absorption, Liquids, X-ray spectroscopy, Hydrocarbons, Mathematical equations.

Recent developments of a novel technique, conductivity measurements of X-ray absorption of liquids, were reported. This method was developed as a technique for liquid state X-ray studies. The implication of different decay channels to the yield spectrum was studied. The X-ray ion yield of the pure hydrocarbon liquids was investigated. The techniques and applications of conductivity measurements of EXAFS were discussed. It was concluded that this technique would greatly facilitate measurements of liquids with low atomic numbers such as organo-sulfur and organochlorine compounds. (Wood-PTT)
W87-08494

AUTOMATIC MONITORING OF SURFACE WATER QUALITY: THE WARNING STATION OF LE MONT VALERIEN WATER TREATMENT PLANT,
Centre de Recherche Lyonnaise des Eaux - Degremont, Le Pecq (France).
L. Cognet, P. Jacq, and J. Mallevialle.
Aqua AQUAAA, No. 1, p 22-27, 1987. 11 fig, 8 ref.

Descriptors: *Measuring instruments, *Water quality, *Automation, *Autoanalyzers, *Warning systems, Drinking water, Surface water, Heavy metals, Chemical analysis, Seine River.

Different types of analyzers that can be used for water quality monitoring stations (WQMS) are discussed. 'Warning systems' are distinguished from 'automatic analytical systems'. A recently installed WQMS (Le Mont Valerien water treatment plant, downstream from Paris on the Seine River) is described. This plant uses new types of analyzers (e.g., for heavy metals). Some of the constraints (methodological, technical, financial) that govern location and design of a plant are outlined. It is foreseen that new technologies in the sensor, computer, and communications fields will smooth some of the difficulties that remain in analyzer use. (Airone-PTT)
W87-08519

COMPUTERISED CHECKING OF SURFACE WATER TO BE USED FOR DRINKING PURPOSES,
Azienda Servizi Pubblici Idraulici e Vari, Venice (Italy).
A. Ross.
Aqua AQUAAA, No. 1, p 28-31, 1987. 2 fig.

Descriptors: *Computers, *Automation, *Drinking water, *Water treatment, *Monitoring, Surface water, Chemical analysis, Urbanization, Water Pollution sources, Self-purification, Venice.

The monitoring system and checking methods described are used to control the relevant chemical parameters of water drawn from the river Sile which forms one of the main sources of water supply for Venice, Italy. The monitoring system consists of two sampling and monitoring stations, the first one located at the entrance of the 11 km long canal connecting the river to the conditioning plant (to provide early warning against pollution), the second one located at the entrance of the water conditioning plant to provide further safety against pollution phenomena in the canal tract and tuning for the conditioning plant operation. Both stations are computer controlled to provide real-time evaluation of incoming water quality, immediate singling out and measurement of eventual pollutants and - through a series of chemical correlations extrapolated from relevant past data - the determination of the probable pollution source. (Author's abstract)
W87-08520

COMPARISON OF HEAD-SPACE AND EXTRACTION TECHNIQUE IN THE GAS CHROMATOGRAPHIC DETERMINATION OF HALOGENATED HYDROCARBONS USING A STATISTICAL MODEL TO EVALUATE SYSTEMATICAL ERRORS (VERGLEICH DER HEAD-SPACE-TECHNIK MIT DER EXTRAKTIONS-METHODE IN DER GASCHROMATOGRAPHIE BEI DER HKW-BESTIMMUNG MIT EINEM STATISTISCHEN MODELL ZUR ERKENNUNG SYSTEMATISCHER FEHLER),
Landesamt fuer Wasserwirtschaft Rheinland-Pfalz, Mainz (Germany, F.R.).
C. Bieber, V. Dammann, W. Funk, G. von Marcard, and D. Rinne.
Zeitschrift fuer Wasser- unf Abwasser Forschung, Vol. 20, No. 1, p 22-28, February 1987. 1 fig, 8 tab, 22 ref.

Descriptors: *Pollutant identification, *Analytical methods, *Gas chromatography, *Comparison studies, Treatment of errors, Statistical analysis, Halogens, Chlorinated hydrocarbons, Drinking water.

The extraction method and head-space technique for determination of volatile halogenated hydrocarbons using GC are compared. The comparison is based on investigations of systematic deviations from the pure gas chromatography procedure. The statistical model used for this purpose has proven itself and will be an ideal complement to well-established equivalence tests of analytical methods. Some of the nine compounds used in this test show constant systematic errors in both modes while proportional systematic errors occur in all cases. Since the magnitudes of the deviations are the same for both methods, their comparability is a given with respect to this test. (Author's abstract)
W87-08529

CURRENT DPD METHODS FOR DISINFECTANT RESIDUAL MEASUREMENT,
For primary bibliographic entry see Field 5F.
W87-08531

MUTAGENS IN WATER SOURCES: DETECTION AND RISK ASSESSMENT,
Severn-Trent Water Authority (England).
R. J. Tye.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 6, p 541-548, December 1986. 22 ref.

Descriptors: *Water pollution effects, *Pollutant identification, *Carcinogens, *Drinking water, *Bioassay, Epidemiology, Risks, Organic compounds, Chlorination, Activated carbon.

There is increasing evidence that chemicals, both manmade and natural in origin, are involved in human carcinogenesis. Since the large amount of both work on and interest in the organic micropollutants present in drinking waters, the possibility has arisen that these compounds may contribute to the level of cancer found in human populations. Two techniques have been applied to quantify any effects: epidemiological surveys on human populations and long-term studies involving the treatment of laboratory animals. Recently, the development of short-term tests, including mutagenicity assays, has allowed some preliminary screening for potential carcinogenic activity. This has considerably widened the scope for investigation, as these tests can be executed at a fraction of the time and cost of conventional carcinogenicity assays. A selection of these tests are reviewed, and the general trends reported when these tests are applied to drinking water and related samples (e.g., samples from groundwater, river water, surface water, water treated with activated carbon, distributed water, and chlorinated water. (Author's abstract)
W87-08533

VIRAL POLLUTION OF COASTAL WATERS RESULTING FROM THE DISPOSAL OF UNTREATED SEWAGE EFFLUENTS,
Institut Pasteur Hellenique, Athens (Greece). Dept. of Virology.
For primary bibliographic entry see Field 5B.
W87-08543

PRELIMINARY RESULTS OF THE JOINT ITALIAN-YUGOSLAV RESEARCH PROGRAM ON THE POLLUTION OF THE ADRIATIC SEA,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5B.
W87-08567

EUTROPHICATION OF COASTAL WATERS - GULF OF TRIESTE,
Trieste Univ. (Italy). Ist. di Idraulica.
For primary bibliographic entry see Field 5B.
W87-08568

SPECTROPHOTOMETRIC DETERMINATION OF INORGANIC PHOSPHATE IN EGYPT WATER USING RESAZURINE AND PARA-ROSOLIC ACID,
Mansoura Univ. (Egypt). Faculty of Pharmacy.
S. M. Hassan, and F. B. Salem.
Analytical Letters ANALBP, Vol. 20, No. 1, p 1-10, January 1987. 3 fig, 1 tab, 9 ref.

Descriptors: *Analytical methods, *Resazurine, *Para-rosolic acid, *Phosphates, *Spectrophotometry, *Chemical analysis, Chemical reactions, Trace levels, Egypt, Absorption, Reagents.

A sensitive method for rapid determination of inorganic phosphate in water samples is described which is based on a reaction between phosphomolybdate and resazurine; phosphomolybdate and para-rosolic acid. The molar absorptivities are 2867.5, 2456.9 at 495 and 470 nm with resazurine and para-rosolic acid reagents. Phosphate can be determined in concentration range of 0.02 to 0.08 ppm, and of 0.02 to 0.16 ppm with resazurine and para-rosolic acid reagents respectively. Both of these sensitive reagents were applied to the determination of trace amounts of phosphate in Egyptian water samples. (Wood-PTT)
W87-08578

ULTRATRACE ANALYSIS OF MERCURY AND METHYLMERCURY (MM) IN RAIN WATER USING COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRY,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
R. Ahmed, K. May, and M. Stoeppler.
Fresnius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 326, No. 6, p 510-516, March 1987. 5 fig, 6 tab, 15 ref.

Descriptors: *Trace metals, *Trace elements, *Water analysis, *Acid rain, *Ultratrace analysis, *Mercury, *Rainfall, *Atomic absorption spectrometry, *Analytical methods, *Measuring instruments, *Heavy metals, Precipitation, Methylmercury, Sample preparation.

Ultratrace analysis of mercury in rain water has been investigated, including recovery of ionic mercury with the addition of acids, treatment and storage and stability studies of mercury in rain water. Recovery of ionic mercury from rain water samples increased with increased acid concentrations and increased substantially with UV-irradiation. Recovery of ionic mercury in the presence of different acids was compared. Treatment studies of rain water for the analysis of total mercury were done using different decomposition methods. More than 20% of the total mercury was found in rain water residue after filtration through 0.45 micron membrane filters. Methylmercury (MM) content in filtered and unfiltered rain water however was nearly the same. On long term storage of rain water without acids at pH = 2.0 and 4.5 loss of total mercury occurred, but in the presence of acids increasing amounts of ionic mercury were recovered from rain water samples with increasing storage time. Naturally occurring organic mercury in rain water was quite stable of acidified with 5% HCl. (Author's abstract)
W87-08599

PRECONCENTRATION METHOD FOR PHOSPHATE IN WATER USING ACTIVATED CARBON LOADED WITH ZIRCONIUM,
Shimane Univ., Matsue (Japan). Dept. of Chemistry.
H. Hashitani, M. Okumura, and K. Fujinaga.
Fresnius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 326, No. 6, p 540-542, March 1987. 4 fig, 13 ref.

Descriptors: *Water analysis, *Analytical methods, *Preconcentration, *Sample preparation, *Phosphates, *Activated carbon, *Zirconium, Aqueous solutions, Performance evaluation, Adsorption, Orthophosphates.

An effective and simple method for preconcentration of phosphate in aqueous solution has been developed, using activated carbon loaded with zirconium (Zr-C*). The Zr-C* was prepared by mixing 100 ml of zirconyl nitrate solution (1 g Zr, pH 1.6) with 10 g of activated carbon at 25 C for three days, filtering and drying the residue in air. 10 g of the resulting material included 0.5 g to 0.6 g of zirconium. The adsorption of phosphate and its desorption depend only on the pH of solution. They occur quantitatively and instantaneously at pH below 8.0 and above 13.5, respectively. An aqueous solution with the pH adjusted to 1.5 is passed through the Zr-C* bed formed on a membrane filter paper with the aid of suction. The collected phosphate is then recovered by eluting with 40 ml of 1 M sodium hydroxide solution. Pyrophosphate, tripolyphosphate and metaphosphate behave as similar as orthophosphate. (Author's abstract)
W87-08600

5B. Sources Of Pollution

RATES OF DISSOLUTION AND BIODEGRADATION OF WATER-INSOLUBLE ORGANIC COMPOUNDS,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
J. M. Thomas, J. R. Yordy, J. A. Amador, and M. Alexander.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 290-296, August 1986. 7 fig, 24 ref. PHS Grant ES-07052.

Descriptors: *Fate of pollutants, *Solubility, *Microbial degradation, *Biodegradation, *Organic compounds, *Bacterial physiology, *Kinetics, Bio-

logical wastewater treatment, Wastewater treatment, Bacteria, Growth rates, Population dynamics, Growth media, Culture media, Hydrocarbons, Pollutants, Insecticides, Pesticides, Carbamate pesticides, Chemical reactions.

The relationship between the dissolution rates of organic compounds that are sparingly soluble in water and the biodegradation of these compounds by mixed cultures of bacteria was studied. The rates of dissolution of naphthalene and 4-chlorobiphenyl were directly related to their surface areas. The bacteria caused a decline in the concentration of the soluble substrate. The rate of bacterial growth fell abruptly when 4-chlorobiphenyl or naphthalene was no longer detectable in solution. The population continued to increase in media with different surface areas of insoluble 4-chlorobiphenyl, but the final counts were higher in media in which the surface areas of the substrate were larger. The rates of dissolution of palmitic acid, octadecane, di(2-ethylhexyl) phthalate (DEHP), and carbaryl were determined in the absence of microorganisms. A mixed culture of microorganisms mineralized palmitic acid, DEHP, and carbaryl at a logarithmic rate, while octadecane mineralization was linear. The rates of mineralization at the end of the active phase of the biodegradation were lower than the rate of dissolution of palmitic acid but higher than the rate of dissolution of octadecane in the uninoculated medium. It is suggested that spontaneous dissolution rates are only one of the factors that govern the rates of biodegradation. (Author's abstract)
W87-07597

AEROBIC METABOLISM OF TRICHLOROETHYLENE BY A BACTERIAL ISOLATE,
Technology Applications, Inc., Gulf Breeze, FL.
For primary bibliographic entry see Field 2H.
W87-07599

DISPERSION OF POLLUTANTS IN RIVERS,
Institute of Meteorology and Water Management, Warsaw (Poland).
W. Czernuszenko.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 1, p 59-67, March 1987. 3 fig, 4 ref.

Descriptors: *Path of pollutants, *Polluted rivers, *Dispersion, *Advection, *Mathematical equations, Simulation, Mixing, Channels, Rivers, Pollutants.

The problem under consideration is the mixing of conservative, nonbuoyant pollutants released into a river. Such pollutants are mixed with the water of a river by different mechanisms, i.e. molecular diffusion, turbulent diffusion, advection and dispersion. These mechanisms are explained. One of the most important is dispersion, which is derived and described in the paper. The mixing process in rivers is represented by the advection-dispersion equation. Analyzing this process in irregular rivers is usually impossible because of the lateral advection term in the dispersion equation. However, this term disappears in a special curvilinear coordinate system. Such a system is introduced and a method of solution of the dispersion equation is presented. Two examples of the simulation of a mixing process in curvilinear channels are given. (Author's abstract)
W87-07615

CAN GRAIN ABSORB VOLATILE PHENOLS FROM IRRIGATING WATER: THIN-LAYER CHROMATOGRAPHY OF STEAM-VOLATILE PHENOLS IN THE WASTE WATER OF THE PETROLEUM INDUSTRY AND THE GRAIN IRRIGATED BY IT,
Agricultural Biology Research Inst., Beijing (China).
For primary bibliographic entry see Field 5A.
W87-07620

PETERSEN'S BENTHIC STATIONS REVISITED. II. IS THE OSLOFJORD AND EASTERN SKAGERRAK ENRICHED,
Havsfiskelaboratoriet, Lysekil (Sweden).
For primary bibliographic entry see Field 2L.
W87-07630

MATHEMATICAL SIMULATION MODEL FOR ENVIRONMENTAL TRANSPORT PROCESSES IN TIDAL RIVERS AND ESTUARIES,
GKSS - Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik.
For primary bibliographic entry see Field 2J.
W87-07660

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: NITROGEN AND PHOSPHORUS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
F. E. Broadbent, and H. M. Reisenauer.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 12-1 to 12-16, 3 tab. 21 ref.

Descriptors: *Impaired water use, *Water reuse, *Path of pollutants, *Fate of pollutants, *Nitrogen, *Phosphorus, *Groundwater movement, *Wastewater irrigation, Soil contamination, Nitrates, Leaching, Ammonia, Phosphates.

In wastewater irrigation, the primary concern with respect to nitrogen is the possibility of nitrate contamination of domestic water supplies and the attendant risk of methemoglobinemia in human infants. Although the incidence of methemoglobinemia, or 'blue baby disease', in the United States is very low, the Public Health Service has set 10 mg/L nitrate-N as the level that should not be exceeded in drinking water. Methemoglobinemia is much more common in ruminant animals than in humans, but its occurrence is usually associated with high nitrate concentrations in forage rather than in drinking water. Aside from the possible risk of groundwater contamination, it is desirable to recycle nitrogen wherever feasible, since it is an essential nutrient required for the production of food and fiber. Its reuse also represents energy conservation. Nitrogen retention in soil and transformations in soil are discussed, as well as ammonia volatilization, plant uptake of applied nitrogen, and leaching losses. Phosphates added to soil may be taken up by the crop, accumulated by the solid phase of the soil in sorption and precipitation reactions, or lost from the system in percolating and runoff waters or by erosion. Reactions with the soil and crop removal account for the largest fraction of the added P. Only small amounts--less than 3% of that added annually--have been found in drainage waters. (See also W87-07662) (Lantz-PTT)
W87-07674

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: TRACE ELEMENTS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
A. L. Page, and A. C. Chang.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 13-1 to 13-16, 1 fig, 5 tab, 31 ref.

Descriptors: *Impaired water use, *Water reuse, *Path of pollutants, *Fate of pollutants, *Wastewater irrigation, *Soil contamination, *Trace elements, *Groundwater pollution, Toxicity, Vegetation, Path of pollutants, Irrigation practices, Arid regions, Semi-arid regions.

In the soil, uncontrolled trace-element inputs are undesirable, because once accumulated in the soil, these substances are in most cases practically impossible to remove and subsequently may lead to: (1) toxicity to plants grown on the affected soils, (2) absorption by crops, resulting in trace-element levels in the plant tissue considered harmful to the health of humans or animals who consume the crops, and (3) tranposrt from soils to underground or surface water, thereby rendering the water unfit for its intended use. Wastewaters always contain trace elements. Reviewed here is the fate of trace elements applied to soil during wastewater irrigation. The analysis is based upon the quantity of irrigation water that would commonly be applied to irrigate crops in arid and semi-arid regions, which is 4 ft/year (1.2 m/year). (See also W87-07662) (Lantz-PTT)
W87-07675

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: PATHOGENS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. T. Frankenberger.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 14-1 to 14-25, 4 tab, 60 ref.

Descriptors: *Impaired water use, *Water reuse, *Path of pollutants, *Fate of pollutants, *Wastewater irrigation, *Soil contamination, *Groundwater pollution, *Pathogens, Bacteria, Protozoa, Viruses, Hydrogen ion concentration, Temperature, Path of pollutants.

The survival rates of pathogenic bacteria in soil normally vary from one day to several months. Many factors affect the survival of enteric bacteria in soil. Increased soil moisture content, cooler temperatures, and higher organic matter content tend to favor longer survival, but extremely acidic or alkaline conditions, sunlight, and antagonistic microflora are opposing factors to survival. Protozoa and helminths appear to survive as long as enteric bacteria in soil, although ascarris ova may remain viable much longer. Depending on the nature of the soil, temperature, pH, and moisture content, enterovirus survival has been reported to vary from 25 to 170 days. Virus inactivation is promoted by dissaggregation of viral clumps, presence of chloride salts, high temperature and pH, and virucidal chemical species such as ammonia. Suspended organic matter in wastewater (virus-solid association) is believed to have some protective effect on virus survival. The movement of pathogens in soil involves transport by insects, birds, rodents, windblown soil, overland runoff, and percolation through the soil profile to groundwater. Continuous application of wastewater could result in accumulation of pathogens at the soil surface. Pathogen movement in surface runoff water may be a greater hazard for disseminating diseases than pathogen elution to groundwater. The literature indicates excellent removal of viruses through soil columns and adsorption in batch studies. It is evident that viruses differ quite markedly in their survival and removal during percolation through soil. The mobility of viruses in soil is related to viral properties; to the pH, cation exchange capacity, surface area, organic matter content, and texture of the soil; and to the pH, ionic strength, and flow rate of the percolating fluid. Adsorption is the primary mechanism for viral retention in soil and is favored by low flow rates, intermittent loading, high cation exchange capacity, high clay content, high organic matter content, and low pH. Desorption is promoted by percolating fluids with low ionic strength through soil. Wastewater application to soil appears to be very effective in pathogen immobilization and inactivation. (See also W87-07662) (Lantz-PTT)
W87-07676

FATE OF WASTEWATER CONSTITUENTS IN SOIL AND GROUNDWATER: TRACE ORGANICS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
A. C. Chang, and A. L. Page.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 15-1 to 15-20, 5 tab, 33 ref.

Descriptors: *Impaired water use, *Water reuse, *Path of pollutants, *Wastewater irrigation, *Soil contamination, *Groundwater pollution, *Trace levels, Organic compounds, Wastewater treatment, Adsorption, Volatilization, Biodegradation, Pesticides.

Trace organic substances are a group of newly discovered contaminants of water supplies. Since their discovery, several hundred potentially hazardous organic chemicals have been found in natural water, wastewater, and drinking water. Because of the inherent toxic effects associated with many trace organic substances, their presence in the water (even at low concentrations) has caused great concern. Although conventional wastewater treatment processes are not designed for trace-organic removal, such processes can greatly reduce the number and concentrations of trace organics. When trace organics are introduced into the soil through wastewater irrigation, the most effective mechanisms of attenuation are expected to be adsorption, volatilization, and biodegradation. Because there are few data to quantitatively describe the fate of trace organics in soil, the soil adsorption coefficient, water-air partition coefficient, and octanol-water partition coefficient of selected trace organics of the treated wastewater effluent provide useful indexes of the behavior of trace organics. When they are compared with several pesticides whose environmental fate and transport in the soil are well defined, it becomes obvious that most trace organics of the wastewater will be attenuated in the soil in a manner similar to attenuation of pesticide residues. Because the inputs of trace organic matter through irrigation are usually smaller than the application of pesticides, the environmental impact associated with their presence in wastewater effluents is not expected to be very significant. (See also W87-07662) (Lantz-PTT)
W87-07677

ANNUAL REPORT, 1984.
Interagency Task Force on Acid Precipitation, Washington, DC.
For primary bibliographic entry see Field 2B.
W87-07728

IMPACT OF WASTE DISPOSAL IN NEARSHORE ENVIRONMENTS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W87-07730

ACCUMULATION OF POLYNUCLEAR AROMATIC HYDROCARBONS BY THE CLAM MYA ARENARIA,
Department of Fisheries and Oceans, St. Andrews (New Brunswick).
D. W. McLeese, S. Ray, and L. E. Burridge.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 81-88, 1 fig, 3 tab, 8 ref.

Descriptors: *Bioaccumulation, *Path of pollutants, *Waste disposal, *Costal waters, *Water pollution effects, *Aromatic compounds, *Hydrocarbons, *Clams, Marine environment, Marine sediments, Phenanthrene, Triphenylene.

Clams (Mya arenaria) exposed to five polynuclear aromatic hydrocarbon compounds in water had relatively high uptake rates (K sub 1 of 6.3-36.9/hr) and low excretion rates (K sub 2 of 0.006-0.001/hr). Bioconcentration factors ranged from 1100 for phenanthrene to 11,000 for perylene. Clams exposed to sediment contaminated with the hydrocarbons showed similar uptake and excretion patterns for the five compounds. The bioconcentration factors, calculated in relation to the concentration of the hydrocarbons in overlying water, ranged from 1400 for phenanthrene to 4200 for triphenylene and were generally smaller than those from seawater exposure. The bioconcentration factors increased with increasing molecular weight of the hydrocarbons. Although not proven conclusively, the bioavailability of the compounds in sediment to clams appears to be dependent on the presence of the compounds in the overlying water. (See also W87-07729) (Author's abstract)
W87-07732

USE OF BACTERIA, CLOSTRIDIUM PERFRINGENS, IN MARINE SEDIMENTS AS A MONITOR OF SEWAGE PARTICULATE DEPOSITION AND MOVEMENT,
Rhode Island Univ., Kingston. Dept. of Microbiology.
D. J. Emerson, and V. J. Cabelli.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 89-111, 5 fig, 11 tab, 25 ref.
NOAA Grant NA-80RAC00106.

Descriptors: *Bioindicators, *Costal waters, *Clostridium, *Path of pollutants, *Waste disposal, *Marine sediments, *Narragansett Bay, *Rhode Island, *New York Bight, *Bacteria, Ocean dumping, Monitoring, Wastewater disposal, Municipal wastewater, Sludge.

Clostridium perfringens is an obligately anaerobic, spore-forming bacterium present in human feces and found in municipal sewage effluents at densitites of 10,000 - 100,000 organisms/mL. Because the environmentally resistant spores survive for extended periods of time, their densities in marine sediments provide an historical record of the deposition and movement of sewage particulates. This was explored using a relatively facile method developed for the enumeration of the spores in marine sediments. Sediment samples were collected and assayed from two locations: Narragansett Bay, Rhode Island, and the New York Bight. The C. perfringens spore densities in the Narragansett Bay sediments were highest in the upper reaches of the Providence River near the major sources of municipal sewage discharges into the bay and decreased with increasing distance from the discharge sites. They were higher in the East Passage than in the West Passage of the bay. Elevated densities were found in the vicinity of other outfalls and discharges into the bay. The highest C. perfringens densities in the New York Bight apex were found in the sediment samples collected from the deeper waters to the west and southwest of the sewage-sludge dumpsite. This corresponded roughly to the area bounded by the 27-m deep isopleth. The available data suggest little movement of the sludge shoreward to the north and west beyond the 18-m deep isopleth. High C. perfringens spore densities were observed in a sediment sample collected from the mouth of the Hudson Canyon, 40 km south of the dumpsite. (See also W87-07729) (Author's abstract)
W87-07733

HYDROCARBONS IN SOUTHERN CALIFORNIA MUNICIPAL WASTES AND THEIR INPUT TO COASTAL WATERS,
Massachusetts Univ. at Boston. Environmental Science Program.
For primary bibliographic entry see Field 5A.
W87-07736

MODELING EXCHANGEABLE MINOR CATION ADSORPTION IN MARINE SEDIMENTS: PROCESS AND CONTROL OF NH4(+) ADSORPTION,
URS Co., Seattle, WA.
C. D. Boatman.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 187-207, 4 fig, 5 tab, 40 ref.
NSF Grant OCE 78-18746-1.

Descriptors: *Model studies, *Cation exchange, *Marine sediments, *Ammonium, *Path of pollutants, *Waste disposal, *Coastal waters, *Saanich Inlet, *Adsorption, *British Columbia, Marine environment, Ocean dumping, Mathematical models, Lithium, Rubidium, Cesium, Manganese, Strontium, Barium, Organic matter.

The adsorption of exchangeable ammonium and other minor cations in seawater can be described by an expression derived from selectivity coefficients and activities of the major cations. Minor components compete for exchange sites with the major cations, so the amount adsorbed will depend on the activities of these major cations as well as on the activities of the minor components. The final expression has the same form as the Langmuir isotherm. Using experimentally determined selectivity coefficients for a montmorillonite clay and the activities of the major cations in the experimental system, the model can be used to predict an ammonium adsorption constant, at 25 C, of 12.6 + or - 1.7 L/mole. The adsorption constant predicted by the model, at 4 C, of 14.6 + or - 1.9 L/mole, using values for selectivity coefficients predicted from enthalpy data, also agrees with the constant measured at the same temperature, 13.1 + or - 1.5 L/mole for the montmorillonite-rich pelagic clay. The relative strengths of adsorption of the cations follows the series $Li(+) < NH4(+) < Rb(+) < Cs(+)$ for the monovalent cations and $Mn(2+) < Sr(2+) < Ba(2+)$ for the divalent cations. Ammonium adsorption constants were measured for sediments from Saanich Inlet, British Columbia, Canada, before and after the removal of organic matter. The results after extraction suggest that in organic-rich sediment the humic material may be associated with the clay minerals, creating a clay-humic complex that is the actual substrate controlling the ammonium adsorption. In sediments where the organic matter has been removed, or in organic-poor sediments, the clay mineralogy apparently dictates ammonium adsorption behavior. (See also W87-07729) (Author's abstract)
W87-07737

FATE OF METALS IN THE SEDIMENTS OF THE NEW YORK BIGHT,
National Mariculture Centre, Eilat (Israel).
M. D. Krom, K. K. Turekian, and N. H. Cutshall.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 209-234, 6 fig, 9 tab, 41 ref.
NOAA Contract NA79AA01382, and DOE Contract W-7405-eng-26.

Descriptors: *Coastal waters, *Fate of pollutants, *Heavy metals, *Marine sediments, *New York Bight, *Path of pollutants, *Waste disposal, Sand, Organic matter, Clays, Sludge, Particle size, Organic carbon, Dredging, Leachates.

Metal data for the sediments of the New York Bight were assembled; the data base consisted of more than 8000 chemical analyses of 16 elements (Ag, Ba, Cd, Cr, Cu, Fe, Hg, K, Mn, Ni, Pb, Sr, Ti, Rb, V, and Zn) taken from 1000 sampling stations. Other information assembled was sediment grain size, total organic carbon, and loss on ignition. In the New York Bight apex the sediment is composed of two principal components: a sand component low in organic matter and leachable metals, and a silt-clay component high in organic matter and leachable metals. There is a very high correlation, often > 0.9, between Zn, Cr, Cu, Pb, Ni, Fe, Hg, Cd, and organic matter are largely anthropogenic. Conversely, the sediments on the edge of the continental shelf are relatively unpolluted. The Christiaensen Basin, and to a lesser extent, the Hudson Shelf Valley are areas with especially high concentrations of acid-leachable metals. Excess toxic metal concentrations are not found in the sewage dumpsite area; the sludge-originated metals are carried out of the dumpsite by water movement. Metal pollution exists throughout the apex even in areas that are mainly covered with sand. The highest concentrations of metals are in the silt-clay component of the sediments at the dredged-material dumpsite and in the Christiaensen Basin. Sewage sludge appears to be the most important source of metal influx to the sediment, though all three sources (sewage sludge, dredged material, and airborne particulates) have similar fluxes of 10,000 t/yr. (See also W87-07729) (Author's abstract)
W87-07738

METALS IN INTERSTITIAL WATERS OF THE NEW YORK BIGHT DREDGED-MATERIAL DEPOSIT,
Dynamics Solutions Corp., Pasadena, CA.
For primary bibliographic entry see Field 5A.
W87-07739

ORGANIC POLLUTANTS IN NEW YORK BIGHT SUSPENDED PARTICULATES,
Battelle New England Marine Research Lab., Duxbury, MA.
P. D. Boehm, S. Drew, T. Dorsey, J. Yarko, and

N. Mosesman.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 251-279, 8 fig, 4 tab, 37 ref. NOAA Grant NA-80-AA-D-00062.

Descriptors: *Path of pollutants, *Coastal waters, *New York Bight, *Organic compounds, *Pollutant identification, *Suspended particles, *Waste disposal, *Hudson River, Hydrocarbons, Aromatic compounds, Polychlorinated biphenyls, Wastewater disposal, Coprostanol, Sludge, Gas chromatography, Mass spectrometry.

A detailed investigation of polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and coprostanol in the New York Bight system was undertaken; their concentration, composition, and distribution on suspended particulate matter from the Hudson River to the New York Bight were determined. Sewage sludge was richer in organic substances than the mud layer (4.5-9 cm) of a dredged-material core; the sewage contained 14, 4.8, and 2.4 mg/gm of extractable organic matter, saturated hydrocarbons, and aromatic material, respecitvely; the dredged-material contained 3, 0.7, and 0.5 mg/gm of extractable organic matter, saturated hydrocarbons, and aromatic material, respectively. Fused silica capillary gas chromatography and gas chromatographic mass spectrometry were employed for PAH, PCB, and coprostanol determinations. The PAH compounds were abundant (47 micrograms/gm) in sewage sludge. The PCB concentrations in dredged material and sewage sludge from metropolitan New York ranged from 0.4 to 6.9 and from 3.5 to 6.4 micrograms/gm (dry wt), respectively. Coprostanol concentration in sewage-sludge composite samples was 94 microgram/gm. Key flux mechanisms between estuarine and shelf organic chemistry and between benthic and water-column organic chemistry are proposed; the mechanisms include Hudson River and Upper Bay sediment resuspension and bottom-water transport within the estuary, sewage effluent input to harbor-river surface water followed by seward transport, landward transport of resuspended bight sediment linked to resuspension of PAH-rich dredged material, and possible transport of sewage-associated organic particulates down the Hudson Valley. Sediment particle size-organic substance associations revealed that dredged material is rich in pyrogenic PAHs and sewage sludge is rich in petroleum PAHs; the dredged material and sewage sludge behaved dissimilarly with respect to the associations of size, PAHs, and PCBs. The PAHs, PCBs, and coprostanol are decoupled in the water column particulates, probably due to differential solubility behavior of the three compound classes. (See also W87-07729) (Author's abstract)
W87-07740

GEOCHEMISTRY OF THE DALHOUSIE OCEAN DUMPSITE,
OceanChem Ltd.., Dartmouth (Nova Scotia).
S. D. MacKnight.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 281-301, 10 fig, 5 tab, 22 ref.

Descriptors: *Waste disposal, *Coastal waters, *Path of pollutants, *Dalhousie Harbor, *New Brunswick, *Geochemistry, Ocean dumping, Marine sediments, Harbors, Zinc, Copper, Lead, Cadmium, Heavy metals, Sediment transport.

In 1972, disposal of sediment dredged from Dalhousie Harbour in New Brunswick was restricted to a 25-m-deep ocean dumpsite located 15 km from the harbor in the Bay of Chaleur. Between 1972 and 1978, approximately 280,000 cu m of dredged material containing elevated concentrations of zinc (140-980 mg/kg, dry wt), copper (not given), lead (not given), and cadmium (1.4-2.7 mg/kg) were dumped. In early 1973, the disposal site was changed to an intertidal location in Dalhousie Harbour. The oceanic dumpsite remained unused until reactivation was proposed in 1980 as an alternative to unconfined shoreline disposal. Geochemical surveys were conducted in 1978 and 1980. The 1978 study showed that although the dumpsite was not physically discernible from the general bottom structure, the metal distribution clearly outlined the disposal site. Cadmium concentration was particularly high (1-2 mg/kg, dry wt) near the dumpsite center. Results of the partial chemical leaches indicated a strong organic-particle-metal association (80-90% of total metals), reflecting the organic-rich anoxic sediments dredged from Dalhousie Harbour. By 1980, a decrease in concentrations of cadmium and zinc and a westward skew of the highest metal concentrations from dumpsite center had occurred. Geochemical partitioning showed a transfer of both metals-from the reducing-agent-extractable group for cadmium and from the residual phase for zinc. These transfers and losses were attributed to transport of sediment and changes in the redox potential of the sediments. (See also W87-07729) (Author's abstract)
W87-07741

ENERGETICS OF DREDGED-MATERIAL DISPERSAL,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. Bokuniewicz.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 305-317, 8 fig, 11 ref.

Descriptors: *Coastal waters, *Sediment transport, *Density currents, *Path of pollutants, *Waste disposal, *Dredged material, Monitoring, Energy, Ocean dumping, Potential energy, Slurries.

Energy changes may be used to monitor dredged material that is released from scows or hopper dredges at open-water disposal sites. For many minutes after the discharge, almost all of the dredged material travels in a well-defined turbid plume. Measurements of the total energy density of this plume during discharge may serve as a basis to describe and compare the short-term behavior of dredged material, in particular to estimate the distance that the material will spread over the bottom and to assess the influence of bottom topography on the spread of dredged material during the discharge. An energy balance calculation requires measurements of the speed, density, and size of the slurry of dredged material in order to determine both its kinetic and potential energy. Changes in the energy density are relatively large and are determined by the conservation of scalar quantities. Observations made during the U.S. Army Corps of Engineers Dredged Material Research Program indicate that only about 10% of the potential energy of the dredged material in the scow or hopper appears in the slurry that spreads over the seafloor. The maximum spread of material is the distance between the initial contact point and the point where the energy gradient intersects the bathymetry. For a slurry with a concentration of about 5 gm/L traveling over a flat seafloor, energy dissipation is sufficient to bring the slurry to rest in a few minutes or a few tens of minutes. Such a slurry should travel indefinitely down slopes as low as 3 degrees; likewise, the distance covered by the slurry should be restricted greatly if it is traveling up slopes of a few degrees. (See also W87-07729) (Author's abstract)
W87-07742

SEDIMENT BUDGET NEAR THE NEW YORK BIGHT DUMPSITES: IMPLICATIONS FOR POLLUTANT DISPERSAL,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 2J.
W87-07743

ACOUSTIC STUDY OF DREDGED-MATERIAL DUMPING IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
J. J. Tsai, and J. R. Proni.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 357-381, 10 fig, 2 tab, 18 ref.

Descriptors: *Coastal waters, *Path of pollutants, *Waste disposal, *Dredging, *New York Bight, *Acoustics, Water column, Stratification, Salinity, Model studies, Suspended load, Particle size.

In June 1979 an experiment on the disposal of dredged material in the New York Bight apex was performed in which acoustical, chemical, and hydrographic data were obtained. Prior to the disposal, the water column was clearly stratified, presenting both a potential dispersion floor and a dispersion ceiling. Immediately after the disposal operation, two surface sublayers with different salinities appeared on the temperature-salinity diagram, indicating a less saline surface layer at the dumpsite. The floor and ceiling effects were shown in the plume structure obtained by acoustic measurement. A two-process diffusion, calculated fromm the Joseph-Sendner model, was observed; each process exhibited a different diffusion velocity and spatial variation. The highest particle concentrations decayed by the second power of time. The variances were one order of magnitude larger than the average source diffusion, probably due to the larger settling velocity of dredged material during the measured period. The particle budget based on the acoustic calculations decreased exponentially as a function of time of each of the three water layers (surface, pycnocline, and bottom nepheloid) as well as for the water column as a whole. Direct relationships were found between observed acoustic intensity and calculated acoustic intensity and between measured total suspended matter and total suspended matter calculated by using numbers of particles and particle sizes. (See also W87-07729) (Author's abstract)
W87-07744

CONTINUOUS MEASUREMENT OF THE DISPERSION OF SEWAGE SLUDGE,
Brookhaven National Lab., Upton, NY.
S. A. Oakley, I. W. Duedall, J. H. Parker, and J. R. Proni.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 383-408, 14 fig, 1 tab, 27 ref.

Descriptors: *Coastal waters, *Path of pollutants, *Waste disposal, *Wastewater disposal, *New York Bight, *Chemical analysis, Sludge, Spatial distribution, Temporal distribution, Water temperature, Salinity, Dissolved oxygen, Nutrients, Adenosine triphosphate, Mixing, Biochemistry.

Three controlled sewage-sludge dumping experiments involving moving and stationary dumping in the New York Bight apex were conducted in July 1976; the goal was to obtain results on short-term spatial and temporal variations in sludge components in the water column after dumping events and to determine the length of time needed for the water column to return to the predumping state. Water column properties measured before and after sludge discharge were temperature, salinity, dissolved oxygen, nutrients, and adenosine triphosphate. After the moving dump, which is associated with a large amount of turbulent mixing from the wake of the barge, sludge components were rapidly mixed within the pycnocline. Except for ammonium concentrations, the water column returned to predump conditions within 3 hr after dumping. Horizontal underway (continuous) mapping of the sludge plume at the surface and at 1-, 6-, and 8-m depths showed the presence of several areas of sludge-seawater mixtures that appeared as oscillations in the concentration field. After the stationary dump, concentrations of sludge components (both dissolved and particulate) in the water column were greatest at approximately 5 m deep. Biological decomposition of sludge, as inferred from adenosine triphosphate production in dialysis bag experiments, occurred rapidly within 48 hr after a moving dumping event. (See also W87-07729) (Author's abstract)
W87-07745

MINING WASTE DISPOSAL IN NORWAY: A CONFLICT BETWEEN FISHERIES AND INDUSTRY,
Fiskeridirektoratets Havforskningsinstitutt, Bergen (Norway).
For primary bibliographic entry see Field 5E.
W87-07746

ORGANIC COMPLEXANT-ENHANCED MOBILITY OF TOXIC ELEMENTS IN LOW-LEVEL WASTES: QUARTERLY PROGRESS REPORT, JANUARY-MARCH 1984,
Battelle Pacific Northwest Labs., Richland, WA.
J. L. Swanson.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84014810. Price codes: A02 in paper copy, A01 in microfiche. Report No. PNL-4965-3, June 1984. 18 p, 3 fig, 2 tab, 11 ref. NRC Contract DE-AC06-76RLO 1830.

Descriptors: *Waste disposal, *Groundwater pollution, *Organic compounds, *Path of pollutants, *Toxic elements, *Radioactive wastes, *Plutonium radioisotopes, Nickel radioisotopes, Americium radioisotopes, Adsorption, Radioisotopes.

Described are the results obtained during the third quarter's activities of a project whose objective is to determine how and to what extent organic complexants affect the mobility of toxic elements in subsurface groundwaters at commercial low-level waste disposal sites. This project studies non-radioactive toxic elements as well as elements having radioactive isotopes of importance (e.g., 60-Ni, 239-Pu, 241-Am). Organic complexants used in the nuclear industry are being emphasized, but others are also examined. Generic soil components are employed (e.g., hydrous oxides, silica, clays) so that the results will be broadly applicable. Substantiation of the previously-indicated sorption of a Pu(IV)-EDTA complex by hydrous ferric oxide (Fe2)3.xH2O) was obtained by comparing the sorption of EDTA in the presence and absence of Pu. Additional data on the sorption of a Ni-EDTA complex by Fe2O3.xH2O were also obtained. Preliminary Ni sorption data were obtained with other complexants (picolinic acid and citric acid), and another generic soil component (TiO2). Sorption of a Ni-EDTA complex by an anion exchange resin was observed. Complexed species are thus likely to be present in the resin wastes from certain reactor decontamination solution clean-up operations. An experimental problem that caused some erroneous results for uncomplexed Ni was discovered and corrected. The filters being used to assure good separation of solid and liquid phases were removing Ni from solution, which skewed some earlier results. (Author's abstract)
W87-07751

SOLUTION OF CONTAMINANT TRANSPORT EQUATIONS USING AN ORTHOGONAL-UPSTREAM FINITE ELEMENT SCHEME,
Oak Ridge National Lab., TN.
G. T. Yeh.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84014266. Price codes: A02 in paper copy, A01 in microfiche. Report No. CONF-840688--2, (1984). 14 p, 4 fig, 2 tab, 14 ref. DOE Contract DE-AC05-84OR21400.

Descriptors: *Data interpretation, *Path of pollutants, *Mathematical studies, *Mathematical equations, *Finite element method, Mathematical analysis, Distribution patterns.

An orthogonal-upstream weighting finite element scheme, which will result in a matrix amenable to successive over-relaxation (SOR) solution strategies, is presented for approximatingg the contaminant transport equation in subsurface media. This scheme differs from the standard Galerkin and on-orthogonal-upstream weighting schemes in that the set of weighting functions is required to be orthogonal to the set of basis functions. These weighting functions are referred to as 'orthogonal-upstream' weighting functions and are developed for line, quadrilaterial, and triangular elements. Numerical results have been obtained for two examples and are compared with results of non-orthogonal-upstream weighting schemes. It is found that the direct elimination solutions of the orthogonal-upstream finite element equations yield results comparable to those obtained by the direct solution of the Galerkin and/or non-orthogonal-upstream weighting finite element equations. The SOR computations of the orthogonal-upstream finite element scheme generate convergent solutions for all cases. In contrast, the SOR calculations of the Galerkin and/or non-orthogonal-upstream finite element schemes result in convergent solutions for dispersion-dominant cases, but produce divergent results for advection-dominant cases. For small problems, when the central processing unit (CPU) memory is not a consideration, the direct elimination solutions of the Galerkin and non-orthogonal-upstream finite element methods are the most efficient schemes. For large problems, when SOR iteration must be employed to solve the matrix equation owing to the unavailability of CPU memory, the orthogonal-upstream weighting scheme provides the only alternative because it is the only scheme giving convergent SOR computations for all Peclet numbers. Furthermore, it can be expected, as the size of the problems increases, that the SOR iteration will be more efficient than the direct elimination solution. Hence, even the CPU memory is not a consideration for very large problems, one may still prefer the orthogonal-upstream weighting to the Galerkin or non-orthogonal-upstream weighting because of its susceptibility to the SOR iteration for all Peclet numbers. (Author's abstract)
W87-07752

WATER QUALITY IN DISTRIBUTION NETWORKS,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
For primary bibliographic entry see Field 5F.
W87-07784

TOXICOGENETIC EFFECTS LINKED TO THE CHLORINATION OF DRINKING WATER (EFFETS TOXICOGENETIQUES LIES A LA CHLORATION DES EAUX ALIMENTAIRES),
Liege Univ. (Belgium). Inst. de Pathologie.
N. Degraeve.
Aqua AQUAAA, No. 6, p 333-335, 1986. 2 tab, 26 ref.

Descriptors: *Water pollution sources, *Water treatment, *Chlorination, *Trihalomethanes, *Ames test, Contamination, Organic compounds, Carcinogeus, Mutagens, Risks.

A charasteristic of our industrial society is the presence of a large number of manufactured chemicals, some of which are carcinogenic, in our environment. The Ames test is the most accurate and widely used method to detect the presence of mutation agents. The presence of these agents can be explained by the contamination of subteranean and surface waters by industrial, agricultural, and domestic pollutants and by the formation of chemicals during treatment or distribution of water. Specifically disinfection by chlorination has been found to produce trihalomethanes, CHCl3, CHCl2Br and CHClBr2, which are known carcinoges. However chlorination remains a relatively low risk factor as its reaction products are minute in amounts. But as the pollution increases so does the addition of chlorine to drinking water supply and the concentration of mutagenic substances also increases. (Ray-PTT)
W87-07788

SURVEY OF CONTAMINANT HYDROGEOLOGY IN CANADA,
National Water Research Inst., Burlington (Ontario).
R. E. Jackson.
Eos EOSTA Vol. 68, No. 3, p 35-36, January 1987. 38 ref.

Descriptors: *Path of pollutants, *Hydrogeology, *Pollutants, Education, Granular media, Fractured media.

There are about 250 hydrogeologists in Canada at present. Hydrogeology and/or groundwater hydrology is taught at 10 Canadian universities. Two historical trends in hydrogeology have addressed (1) the microscopic fundamentals of flow in porous media, and (2) the macroscopic conception of groundwater flow. Field-scale testing in contaminant hydrogeology grew rapidly in the late 1970s using nonreactive and reactive tracers to determine the origin of the scale effect, the transport and transformation of organic contaminants, and the groundwater geochemistry of radionuclides. During the same period field testing of the hydraulic and transport properties of fractured media began. Recently acclaimed studies have focused on the simulation of contaminant transport and the development of an expert system for contaminant hydrogeology. (McFarlane-PTT)
W87-07803

UPTAKE, DISTRIBUTION AND RETENTION OF ZINEB AND ZIRAM IN RAINBOW TROUT (SALMO GAIRDNERI),
Ministry of Transport and Public Works, Lelystad (Netherlands). Lab. for Ecotoxicology.
C. J. Van Leeuwen, P. Van Hameren, M. Bogers, and P. S. Griffioen.
Toxicology TXCYAC, Vol. 42, No. 1, p 33-46, December 1986. 6 fig, 34 ref.

Descriptors: *Path of pollutants, *Dithiocarbamates, *Carbamate pesticides, *Fungicides, *Bioaccumulation, Biomagnification, Fish, Trout, Zinc, Zinc radioisotopes, Enzymes, Toxicity.

In short-term static bioaccumulation experiments with 14C-labelled zinc ethylenebisdithiocarbamate (zineb) and zinc dimethyldithiocarbamate (ziram) both compounds were rapidly disseminated through the tissues of rainbow trout. Whole-body accumulation was low, with bioconcentration factors less than 100. Whole-body elimination was rapid with 45% and 25% of the initial radioactivity from ziram and zineb, respectively, being retained by the end of the 16-day depuration period. Pigmented tissues appeared to be major distribution sites. This may be related to the affinity of the compounds and/or their degradation products to melanin or to complexation with phenoloxidase, a copper-containing enzyme involved with melanin synthesis. Autoradiography also revealed a high labelling of thyroid follicles. The results show tha dithiocarbamates are selectively localized in various tissues, reported to be the target organs for their toxic action. The observed differences in toxicokinetics between zineb and ziram may, in part, explain the differences in toxicity to fish between ethylenebisdithiocarbamates and dialkyldithiocarbamates. (Authors' abstract)
W87-07806

ENVIRONMENTALLY SIGNIFICANT PHOTOCHEMISTRY OF CHLORINATED BENZENES AND THEIR DERIVATIVES IN AQUATIC SYSTEMS,
Manitoba Univ., Winnipeg. Pesticide Research Lab.
G. G. Choudhry, G. R. B. Webster, and O. Hutzinger.
Toxicological and Environmental Chemistry TXECBP, Vol. 13, No. 1/2, p 27-83, 1986. 1 fig, 11 tab, 77 ref.

Descriptors: *Fate of pollutants, *Chemical reactions, *Chlorinated hydrocarbons, *Benzenes, *Photochemistry, Aquatic habitats, Pollutants, Organic compounds.

The pollution of soil and aquatic environments by chlorinated aromatic pollutants (CAPs) such as polychlorobenzenes (PCBzs), polychlorophenols (PCPs), polychlorodiphenyl ethers (PCDPEs), phenoxyacetic acids, etc., creates growing public anxiety. Phototransformation is an important process for pollutants in aquatic systems. This article extensively reviews the environmentally significant solution phase photochemistry of PCBzs as well as other CAPs derived therefrom. The paper includes photochemical fate of these CAPs at wavelengths greater than 285 nm on the one hand and their photolysis in solution in aquatic systems on the other. Photolytic reductive dechlorination and isomerization of PCBzs are reviewed together with the photoformation of several products including polychlorobiphenyls (PCBs) from PCBZs. Recently developed phenomena of photoincorporation of PCBzs into humic model monomers is described. This review also describes the environmental photochemistry of chlorobenzene derivatives. (Authors' abstract)
W87-07807

THUNDERSTORMS: AN IMPORTANT MECHANISM IN THE TRANSPORT OF AIR POLLUTANTS,
Maryland Univ., College Park. Dept. of Meteorology.
R. R. Dickerson, G. J. Huffman, W. T. Luke, L. J. Nunnermacker, and K. E. Pickering.
Science SCIEAS, Vol. 235, No. 4787, p 460-465, January 1987. 3 fig, 1 tab, 32 ref. NSF Grant ATM-83-05843.

Descriptors: *Air pollution, *Path of pollutants, *Acid rain, *Thunderstorms, Sulfur, Nitrogen, Hydrocarbons, Ozone, Atmosphere.

Acid deposition and photochemical smog are urban air pollution problems, and they remain localized as long as the sulfur, nitrogen, and hydrocarbon pollutants are confined to the lower troposphere (below about 1-km altitude) where they are short-lived. If, however, the contaminants are rapidly transported to the upper troposphere, then their atmospheric residence times grow and their range of influence expands dramatically. Although this vertical transport ameliorates some of the effects of acid rain by diluting atmospheric acids, it exacerbates global tropospheric ozone production by redistributing the necessary nitrogen catalysts. Results of recent computer simulations suggest that thunderstorms are one means of rapid vertical transport. To test this hypothesis, several research aircraft near a midwestern thunderstorm measured carbon monoxide, hydrocarbons, ozone, and reactive nitrogen compounds. Their concentrations were much greater in the outflow region of the storm, up to 11 km altitude, than in surrounding air. Trace gas measurements can thus be used to track the motion of air in and around a cloud. Thunderstorms may transform local air pollution problems into regional or global atmospheric chemistry problems. (Authors abstract)
W87-07810

TRIALKYLLEAD OCCURRENCE, BIOLOGICAL INTERACTIONS, AND POSSIBLE IMPACT ON FOREST DECLINE,
Max-Planck-Inst. fuer Medizinische Forschung, Heidelberg (Germany, F.R.). Abt. Physiologie.
For primary bibliographic entry see Field 5C.
W87-07820

CHEMISTRY OF FOGWATER AND ESTIMATED RATES OF OCCULT DEPOSITION IN AN AGRICULTURAL AREA OF CENTRAL SWITZERLAND,
Bern Univ. (Switzerland). Inst. of Plant Physiology
For primary bibliographic entry see Field 2B.
W87-07822

IODINATION OF NUTRIENTS IN THE PRESENCE OF CHLORINE BASED DISINFECTANTS USED IN DRINKING WATER TREATMENT,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W87-07834

UNDERGROUND FLOW, TRANSPORT OF POLLUTANTS, MINERALIZATION,
For primary bibliographic entry see Field 2F.
W87-07845

COMPUTER MODEL FOR SIMULATING WATER QUALITY AND QUANTITY IN A WELLFIELD IN AN ALLUVIAL AQUIFER,
Nebraska Univ.-Lincoln. Dept. of Civil Engineering.
M. W. Gilliland, and Q. M. Nguyen.
Ground Water GRWAAP, Vol. 25, No. 2, p 151-159, March-April 1987. 6 fig, 13 ref. Nebraska Water Resources Center Project 402-14.

Descriptors: *Surface-groundwater relations, *Infiltration, *Water quality, *Path of pollutants, *Water supply, *Groundwater management, *Groundwater pollution, *Model studies, *Groundwater, *Alluvial aquifers, *Computer models, *Groundwater movement, Nitrates, Grand Island, Nebraska, Aquifers, Wellfields, Mathematical equations, Mathematical studies, Finite difference methods, Prickett-Lonnquist model, Pollutants, Drawdown.

A surface-water/groundwater interaction computer model was developed for the Grand Island, Nebraska municipal wellfield. This finite-difference model, which is two-dimensional in plan view, includes both quantity and quality components. The quantity component is a modified version of the Prickett-Lonnquist model. Modifications account for the effects of the Platte River channels, which flow through the modeled area, and adjust water levels at pumping wells to account for the difference between the well radius and the grid size. The quality component of the model calculates nitrate concentrations in pumping wells penetrating aquifers which are vertically stratified with respect to nitrate. The model also estimates amounts of recharge from the river to the aquifer and the direction and velocity of movement of groundwater in several nitrate-contaminated areas adjacent to the wellfield. Nitrate is assumed to be a conservative pollutant, and nitrate transport is assumed to be solely due to advection. The model was calibrated using field data collected in 1984 and then verified with field data from two other independent events in 1978 and 1984. The model was used to investigate the impacts of river diversions upstream on the quantity and quality of water in the wellfield. Simulation results indicate that zero-flow conditions in the river cause drawdown to increase greatly, cause nitrate concentration in the pumping wells to increase slightly, and cause the groundwater in the nitrate-contaminated area north of the wellfield to begin moving toward the wellfield. (Author's abstract)
W87-07849

ANALYSIS OF STEADY-STATE SALT-WATER UPCONING WITH APPLICATION AT TRURO WELL FIELD, CAPE COD, MASSACHUSETTS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2F.
W87-07854

SEDIMENT DIATOM AND METAL STRATIGRAPHY FROM ROCKY MOUNTAIN LAKES WITH SPECIAL REFERENCE TO ATMOSPHERIC DEPOSITION,
Colorado State Univ., Fort Collins. Natural Resources Ecology Lab.
J. Baron, S. A. Norton, D. R. Beeson, and R. Herrmann.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 7, p 1350-1362, July 1986. 11 fig, 1 tab, 41 ref. UNESCO Grant RM-81-206GR.

Descriptors: *Limnology, *Stratigraphy, *Rocky Mountains, *Metals, *Diatoms, *Mountain lakes, *Acid rain, *Deposition, *Chemistry of precipitation, Water pollution sources, Bioindicators, Indicators, Heavy metals, Lakes, Precipitation, Rainfall, Acidity, Dating, Lead, Copper, Zinc, Vanadium, Mathematical equations, Prediction, Profiles, Chemical properties.

Experiments were conducted to determine whether current levels of acidity in precipitation falling on Rocky Mountain National Park are greater than historical levels. Sediment cores from four subalpine lakes were sectioned and dated with Pb210. The stratigraphic records of metals were used to detect trends in the deposition of Pb, Cu, Zn, and V because these metals are known to increase in areas receiving air masses polluted with fossil-fuel emissions. Diatom assemblages over time were used as indicators of change in lake water chemistry. Reconstructions of pH from four lakes were prepared using Index B, Index alpha, and predictive equations derived from 19 additional lake surface sediments. The metal stratigraphy, diatom stratigraphy, and inferred pH profiles of the four study lakes indicate no historical influence on pH attributable to atmospheric deposition. However, all four cored lakes showed a persistent increase in the deposition rate of Pb starting in the period between 1855 and 1905. The most likely source of the Pb is airborne particules from mining activity in Colorado which began in the mid-1800s. Recent high levels of Pb within the sediments may be due in part to emissions related to automotive leaded gasoline combustion. (Author's abstract)
W87-07873

EFFECT OF POINT AND DIFFUSE SOURCE LOADINGS ON MERCURY CONCENTRATIONS IN THE WABIGOON RIVER: EVIDENCE OF A SEASONALLY VARYING SEDIMENT-WATER PARTITION,
Ontario Ministry of the Environment, Thunder Bay (Ontario).
J. W. Parks, J. A. Sutton, and A. Lutz.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 7, p 1426-1444, July 1986. 19 fig, 14 tab, 18 ref.

Descriptors: *Limnology, *Water pollution sources, *Mercury, *Seasonal variation, *Path of pollutants, *Sediments, Ontario, Chemical industry, Industrial plants, Wastewater, Industrial wastewater, Heavy metals, Water pollution, Suspended sediments, Suspended solids, Chemical reactions, Chemical properties, Biological properties, Flow, Contamination, Temperature, Temperature effects, Water temperature, Physical properties.

Mercury levels in the surface sediments, water, and suspended sediments of the Wabigoon River downstream of Dryden, Ontario remain markedly elevated 10 years after major mercury loadings from a chlor-alkali plant were sharply reduced. During 1979, a typical water year, average mercury concentrations in water throughout an 80-km reach were nearly five times the mean value at the control site. Elevated mercury levels in the Wabigoon River are primarily due to the chemical and biological remobilization of mercury from sediments. Lesser amounts are due to the erosion of mercury-enriched sediments during high flows and to current releases from the mill site at Dryden. In the absence of resuspended sediment during high flows, mercury levels in contaminated waters can be best described by a sediment-water-suspended solids partition. This condition was established within half a day in the most contaminated portion of the system. Mercury concentrations in water can fluctuate seasonally by an order of magnitude. Highest concentrations were associated with elevated summer temperatures. (Author's abstract)
W87-07875

ZOOPLANKTON AND FISH ACCUMULATE CHLORINATED HYDROCARBONS FROM CONTAMINATED SEDIMENTS,
Lund Univ. (Sweden). Limnological Inst.
P. Larsson.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 7, p 1463-1466, July 1986. 2 fig, 21 ref.

Descriptors: *Limnology, *Zooplankton, *Fish, *Bioaccumulation, *Chlorinated hydrocarbons, *Contamination, *Lake sediments, *Path of pollutants, *Polychlorinated, Biphenyls, Accumulation, Hydrocarbons, Sedimen Plankton, Water pollution, Seasonal variation, Excretion, Equilibrium, Eel, Crustaceans, Environment, Aquatic environment.

Polychlorinated biphenyls (PCBs) originating from the sediment were taken up by zooplankton and fish in artificial ponds in the field. PCB uptake in zooplankton was concentration dependent, as levels of the residues in water varied seasonally. Planktivorous fish accumulated the compounds to high levels at high summer concentrations of PCBs in the water, after which elimination was slow. Levels of PCBs in benthic fishes continuously increased during the 1.5-yr study. The results show that chlorinated hydrocarbons deposited in sediments are available to aquatic organisms. Decreasing levels of PCBs in daphnids in the autumn-winter of 1983 and in the summer of 1984 may be due to different generations of daphnids being exposed to different concentrations of PCBs in the water, thus establishing new partitionings. (Author's abstract)
W87-07876

INFLUENCE OF WATER HARDNESS, PH, AND ALKALINITY ON THE MECHANISMS OF COPPER TOXICITY IN JUVENILE RAINBOW TROUT, SALMO GAIRDNERI,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-07879

LOSS OF LAMPRICIDES BY ADSORPTION ON BOTTOM SEDIMENTS,
National Fishery Research Lab., La Crosse, WI.
For primary bibliographic entry see Field 8I.
W87-07882

WOODY DEBRIS AS A SOURCE OF FINE PARTICULATE ORGANIC MATTER IN CONIFEROUS FOREST STREAM ECOSYSTEMS,
Alabama Univ., University. Aquatic Biology Program.
For primary bibliographic entry see Field 2H.
W87-07886

ZINC AND CADMIUM TRANSPORT BY THE VERTICALLY MIGRATING OPOSSUM SHRIMP, MYSIS RELICTA,
Trent Univ., Peterborough (Ontario). Watershed Ecosystems Program.
J. A. Van Duyn-Henderson, and D. C. Lasenby.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1726-1732, September 1986. 2 fig, 3 tab, 40 ref.

Descriptors: *Zinc, *Cadmium, *Solute transport, *Migration, *Shrimp, *Bioaccumulation, *Path of pollutants, *Biological magnification, Heavy metals, Crustaceans, Zooplankton, Plankton, Feces, Food chains, Food habits, Accumulation, Sediments, Recycling, Distribution, Vertical distribution, Particulate matter.

A study was conducted to examine the possibility that Mysis relicta can transport trace metals from the sediment to the water column and vice versa during diurnal vertical migration, providing a pathway for normally immobile contaminants in the sediments to return to the overlying water. Mysis feeding on sediments were found to ingest 2-4 times more zinc and 8 times more cadmium than mysids feeding on zooplankton. Mysids feeding on sediments egested 3-5 times more zinc and 5-7 times more cadmium than those feeding on zooplankton. Concentrations of zinc and cadmium were 5-24 times higher in the fecal pellets than in the food. There was little difference in the amount of zinc and cadmium transported upward or downward per mysid. However, 3-4 times more zinc and 4-7 times more cadmium were concentrated and recycled by Mysis at the sediments than in the water column. On a population basis, mysids transported 5 micrograms Zn and 0.008 micrograms Cd/cu m/night into the water column and 9 micrograms Zn and 0.020 micrograms Cd/sq m/d to the sediments. It is suggested that mysids and their particulate products (fecal pellets, exuviae) may play an important role in the transport and recycling of cadmium and zinc to other members of the food web. (Author's abstract)
W87-07891

COMPARISON OF THE DIFFERENTIAL ACCUMULATION OF CADMIUM IN THE TISSUES OF THREE SPECIES OF FRESHWATER FISH, SALMO GAIRDNERI, RUTILUS RUTILUS AND NOEMACHEILUS BARBATULUS,
University Coll., Cardiff (Wales). Dept. of Biochemistry.
M. W. Brown, D. G. Thomas, D. Shurben, J. F. L. G. Solbe, and J. Kay.
Comparative Biochemistry and Physiology (C), Vol. 84, No. 2, p 213-217, 1986. 2 fig, 4 tab, 10 ref. NERC Grant GR3/4970.

Descriptors: *Bioaccumulation, *Cadmium, *Tissue analysis, *Trout, *Roach, *Fish, *Mathematical equations, *Fish physiology, *Path of pollutants, Heavy metals, Proteins, Survival, Liver, Water pollution effects.

The total body loads of cadmium accumulated by roach, stone loach, and rainbow trout were found not to correlate directly with the concentration of cadmium to which the species had been exposed. A fractional retention coefficient was therefore devised, which is the quotient of the total body cadmium accumulation (micrograms per 100 g body weight) and the notional cadmium dose (micrograms per liter x weeks). This coefficient was found to be constant for each species at different periods of exposure to cadmium alone. However, values of the coefficient for roach and stone loach were much lower than for rainbow trout. When rainbow trout were preexposed to zinc, the fractional retention coefficient for cadmium fell to a value similar to those seen with roach and stone loach exposed to cadmium alone. The signficance of these observations is discussed in relation to the nature of the intracellular proteins to which cadmium is bound. (Author's abstract)
W87-07918

CONTAMINANT UPTAKE BY FISH AND THE POTENTIAL FOR TRANSFER TO HUMANS MODELLED OVER TIME,
Michigan Univ., Ann Arbor. School of Natural Resources.
A. L. Jensen.
Ecological Modelling ECMODT, Vol. 32, No. 4, p 281-290, July 1986. 5 fig, 1 tab, 10 ref.

Descriptors: *Contaminants, *Bioaccumulation, *Path of pollutants, *Limnology, *Food chains, *Model studies, *Growth rates, Exploitation, Accumulation, *Fish, Growth, Growth kinetics, Dynamics, Foods, Diet, Water pollution, Mathematical models, Mathematical analysis, Estimation, Energy, Oxygen, Mortality, Polychlorinated biphenyls, Trout, Fate of pollutants.

A model was developed that enables coupling of contaminant uptake with the growth dynamics of fish, exploitation, and transfer and fate. Contaminant concentration in fish is a function of the properties of the contaminant, concentrations in the fishes' food and water, and fish growth dynamics; the level of exploitation has a large effect on contaminant concentrations and the potential rates of transfer to humans through its effect on the size and age structure of exploited populations. The coupled model was applied to the dynamics of uptake and the potential for transfer to humans of PCBs by lake trout in the Great Lakes. At the average level of exploitation reported for lake trout, the amount of contaminant that could be transferred was considerably less than the amount that could be transferred at the maximum sustainable yield. It is concluded that it is essential that the biological component of transfer and fate models describe the above aspects of contaminant uptake, but at the same time the model must be relatively simple and must describe uptake as a function of time rather than of age. (Author's abstract)
W87-07969

ASBESTOS FIBERS AND TRACE METALS IN THE BLOOD OF CATTLE GRAZING IN FIELDS INUNDATED BY ASBESTOS-RICH SEDIMENTS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
H. Schreier, J. A. Shelford, and T. D. Nguyen.
Environmental Research ENVRAL, Vol. 41, No. 1, p 99-109, October 1986. 4 tab, 25 ref. NRC Contract OSU83-00076.

Descriptors: *Asbestos, *Trace metals, *Blood, *Cattle, *Grazing, *Sediments, *Path of pollutants, *Water pollution effects, Storms, Tissue analysis, Nickel, Manganese, Heavy metals, Flooding, Geochemistry, Microscopy, Electron microscopy, Microscope analysis, Water analysis, Chemical analysis, Weathering, Chemical composition.

During a major storm in 1975, a pasture was inundated with serpentinitic sediments which are rich in asbestos fibers and trace metals. The effects of this material on beef and dairy cattle grazing at the site was investigated by analyzing blood samples from exposed and control animals for asbestos fibers, trace metals, and general blood chemistry. The analysis showed that at the time of exposure Ni and Mn values were significantly higher in the exposed animals than in the controls, and in six out of seven samples asbestos fibers were present as determined by electron microscopy. Once the animals were removed from the site, trace metal levels returned to normal, although asbestos fibers were still present in three out of seven animals. Two of the control animals unaffected by the sediments also showed asbestos fibers; there were no relationships between the magnitude of fibers and trace metal content. This suggests that the sediments influence the blood chemistry of animals, although the presence and magnitude of asbestos fibers in the blood can be influenced by other factors as well. (Author's abstract)
W87-07987

EFFECT OF WATER ACTIVITY ON LEGIONELLA SPP. GROWTH AND SURVIVAL,
California Univ., Berkeley. Sanitary Engineering Research Lab.
R. E. Danielson, and R. C. Cooper.
Journal of Applied Bacteriology JABAA4, Vol. 61, No. 2, p 157-161, August 1986. 1 fig, 17 ref.

Descriptors: *Available water, *Growth rate, *Survival, *Legionella, *Bacterial physiology, *Microbiological studies, *Public health, *Culturing techniques *Pathogenic bacteria, Bacteria, Escherichia coli, Epidemiology, Isolation, Growth, Ecological distribution, Culture media, Growth media, Agars.

Difficulties in the enumeration of legionellas by plate counting techniques and membrane filter methods occur unless cultures are exposed to very humid conditions, suggesting that the organism's water activity (a sub w) requirements may be restrictive. A series of experiments were therefore performed to determine the effect of a sub w on the growth of Legionella, using L. pneumophila and L. micdadei, with E. coli as a reference organism. The highest growth rates of Legionella were observed at an a sub w of 0.995 and were significantly decreased at lower a sub w values. Cell death usually occurred at a sub w values below 0.980. This sensitivity to a sub w may be an important constraint for the distribution and survival of Legionella in the environment, explaining the inhibition of the growth of these organisms in agar and explaining why they have not been isolated from soil. (Doria-PTT)
W87-07989

COMPARATIVE PATHWAY ANALYSIS OF RADIOCESIUM IN THE HUDSON RIVER ESTUARY: ENVIRONMENTAL MEASUREMENTS AND REGULATORY DOSE ASSESSMENT MODELS,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
P. Linsalata, D. Hickman, and N. Cohen.
Health Physics HLTPAO, Vol. 51, No. 3, p 295-312, September 1986. 3 fig, 8 tab, 31 ref. NIEHS Grant ES 00260, NCI Grant CA 13343.

Descriptors: *Cesium radioisotopes, *Path of pollutants, *Chemical analysis, *Hudson River, *Estuarine environment, *Model studies, *Regulations, Radioisotopes, Environment, Legal aspects, Sediments, Water analysis, Tissue analysis, Fish, Water pollution sources, Food chains, Food habits, Population exposure, Swimming, Recreation, Nuclear reactors, Radioactive wastes, Shores, Model studies, Pollutant identification.

Environmental measurements and dosimetry were conducted for reactor-released 137Cs and 134Cs and weapons-produced 137Cs in water, shoreline sediment, and fish collected from 1971 to 1980 in the Hudson River Estuary. Trends in annual mean concentrations and resulting dose implications for man from each source are discussed. Human exposure pathways examined include fish consumption, water consumption, swimming, and recreational use of the shoreline. Based on environmental measurements, a maximum, adult, whole-body, 50-y committed effective dose equivalent (CEDE) of 79 microrem is estimated from fish consumption in

1971, the year of maximum reactor discharge of the radiocesiums. Estimates from other pathways are: downstream fish consumption, 5 microrem; upstream water consumption, 2 microrem; swimming, 0.01 microrem. External, whole-body exposure from recreational shoreline use downstream is estimated to be 46 micro rem/yr. These estimates are based on consumption factors of 3.9 and 803 kg/y (fish and water, respectively), and on usage factors of 50 and 140 h/y (swimming and shoreline recreation, respectively). Discrepancies between these results and models currently recommended by the Nuclear Regulatory Commission are discussed. (Author's abstract)
W87-07991

TISSUE DISPOSITION OF 109CD(2+) IN THE BROWN TROUT (SALMO TRUTTA) STUDIED BY AUTORADIOGRAPHY AND IMPULSE COUNTING,
Sveriges Lantbruksuniversitet, Uppsala. Dept. of Pharmacology and Toxicology.
H. Tjalve, J. Gottofrey, and I. Bjorklund.
Toxicological and Environmental Chemistry TXECBP, Vol. 12, No. 1/2, p 31-45, 1986. 2 fig, 2 tab, 17 ref.

Descriptors: *Path of pollutants, *Bioaccumulation, *Tissue analysis, *Trout, *Cadmium radioisotopes, *Autoradiography, *Spectrometers, Water pollution effects, Radioisotopes, Gills, Cadmium, Heavy metals, Accumulation, Kidney, Blood, Radioactivity techniques, Radiochemical analysis.

Brown trout were exposed to 109Cd(2+) in concentrations of 0.1, 0.5, 1.0, and 10.0 micrograms/l in aquarium water during one or two weeks. The disposition of the 109Cd(2+) in the tissues was then examined by whole-body autoradiography and gamma spectrometry. The tissues accumulating the highest levels of 109Cd(2+) were the olfactory apparatus, the gills, and the trunk kidney. 109Cd(2+) in the gills comprised from about 75% to about 40% of the total body burden of the metal, the highest proportions being present at the lowest cadmium concentrations in the water and at the one week exposure interval. The liver accumulated a considerable concentration of 109Cd(2+); the lowest levels were registered in the muscles. Average whole-fish accumulation of 109Cd(2+) was about 50-100 times at the lower concentrations, whereas at 10 micrograms/l of 109Cd(2+), average bioaccumulation had diminished to about 10-20 times. The saturation of the uptake in the tissues at this concentration was most marked in the gills. Results show that some trout tissues can strongly concentrate cadmium from low water concentrations. The accumulation in the olfactory apparatus suggests that cadmium may be injurious to the olfactory sense. (Author's abstract)
W87-08001

STUDY OF THE SUBSTRATE INFLUENCE ON THE FREE FATTY ACIDS PRODUCTION DURING GROWTHS OF MARINE BACTERIA ON DIFFERENT HYDROCARBONS,
Centre d'Oceanologie de Marseille (France).
J. F. Rontani, and G. Giusti.
Toxicological and Environmental Chemistry TXECBP, Vol. 12, No. 1/2, p 61-75, 1986. 6 fig, 2 tab, 18 ref.

Descriptors: *Fate of pollutants, *Oil spills, *Biodegradation, *Substrates, *Fatty acids, *Hydrocarbons, *Marine bacteria, *Growth media, *Bacterial physiology, Microbiological studies, Bacteria, Metabolism, Excretion, Fermentation, Degradation, Solubility, Aromatic compounds, Surfactants, Culturing techniques, Chromatography, Gas chromatography, Mass spectrometry.

Experiments were conducted to link the composition of free fatty acids excreted by a mixed marine bacterial community to the nature of the substrate. Substrates selected were (1) aromatic hydrocarbons of alkylbenzene and naphthenoaromatic types; (2) n-paraffinic compounds; and (3) a branched paraffin (pristane). Products were identified using gas chromatography and gas chromatography/mass spectrometry. Results demonstrated excretion of saturated and monounsaturated straight-chain fatty acids. Because of their surface-active properties, these acids excreted with glycolipidic complexes increase the solubility of hydrocarbons in the aqueous phase and facilitate the biodegradation. Fatty acid composition does not change with the nature of the substrate if its biodegradation does not lead to the formation of propionic acid. The excreted fatty acids are invariably saturated and monounsaturated and are composed of a higher proportion of acids with an even carbon atom number. In the particular case of n-paraffins, owing to the formation of fatty acids by direct oxidation of the substrate, the fatty acid composition of the culture medium depends on the substrate carbon number. (Doria-PTT)
W87-08002

EFFECT OF COPPER AND CADMIUM ON CARBON ASSIMILATION AND UPTAKE OF METALS BY ALGAE,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
P. A. Azeez, and D. K. Banerjee.
Toxicological and Environmental Chemistry TXECBP, Vol. 12, No. 1/2, p 77-86, 1986. 4 tab, 22 ref.

Descriptors: *Water pollution effects, *Heavy metals, *Copper, *Cadmium, *Carbon, *Bioaccumulation, *Metals, *Chlorophyll a, *Cyanophyta, *Algae, Culturing techniques, Plant physiology, Photosynthesis, Photometry, Spectrophotometry, Pigments, Enzymes.

Two species of blue green algae (Spirulina platensis and Anacystis nidulans) grown in artificial aqueous media were treated with Cu and Cd in concentrations of 0.01, 0.1, 1.0, and 10 ppm to study carbon assimilation and chlorophyll (Chl) a content. The species were treated with concentrations of 0.1, 0.5, 1.0, 5.0, and 10.0 ppm to study the uptake of metals with exposure time. Carbon assimilation and Chl a content showed responses proportional to the concentration in the general form $y = K + n(\ln C)$, where C is the concentration of metal in ppm. In the case of uptake, the relation was $y = K$ times C to the nth power (where C is the molar concentration of the metal x 0.000001). The n values in the case of uptake were found to be < 1, indicating a non-Langmuir type of sorption. The concentration factors of metals decreased with metal concentration in the medium, indicating a saturation effect of the absorption of metal species by algae. (Author's abstract)
W87-08003

BIOCONCENTRATION OF BUTYLTIN COMPOUNDS BY ROUND CRUCIAN CARP,
Shiga Prefectural Inst. of Public Health and Environmental Science, Otsu (Japan).
T. Tsuda, H. Nakanishi, S. Aoki, and J. Takebayashi.
Toxicological and Environmental Chemistry TXECBP, Vol. 12, No. 1/2, p 137-143, 1986. 4 fig, 1 tab, 7 ref.

Descriptors: *Path of pollutants, *Bioaccumulation, *Tin, *Butyltin compounds, *Carp, *Biological magnification, *Solubility, *Partition coefficients, *Tissue analysis, *Organometallic compounds, Fish, Muscle, Liver, Kidney, Pesticides, Chromatography, Gas chromatography, Sample preparation, Reagents.

Bioconcentration factors (BCF) by round crucian carp and octanol-water partition coefficients (Pow) were measured for dibutyltin, tributyltin, and triphenyltin compounds. Water analysis was performed by electron-capture gas chromatography (ECD-GC), and tissue analysis by ECD-GC after cleanup by silica gel column chromatography. Pow was 0.97 for 7 organotin compounds. BCF of tributyltin and triphenyltin compounds was 1.70-2.77 for muscle, 1.70-2.66 for vertebra, 2.05-3.70 for liver, and 1.49-3.50 for kidney. The correlations between log Pow and log BCF were investigated. Correlations were r=0.6049 for muscle and r=0.5039 for vertebra. These results are lower than for most compounds, possibly because of metabolism or steric hindrance. (Doria-PTT)
W87-08006

CONTAMINATION OF STREAM FISHES WITH CHLORINATED HYDROCARBONS FROM EGGS OF GREAT LAKES SALMON,
Michigan Dept. of Natural Resources, Ann Arbor. Inst. for Fisheries Research.
J. W. Merna.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 1, p 69-74, January 1986. 1 fig, 2 tab, 17 ref.

Descriptors: *Contamination, *Salmon, *Streams, *Chlorinated hydrocarbons, *Bioaccumulation, *Fish eggs, *Great Lakes, *Path of pollutants, Hydrocarbons, Organic compounds, Eggs, Diets, Food habits, Food chains, Accumulation, Spawning, Lakes, Anadromous fish, Polychlorinated biphenyls, DDT, Dieldrin, Sculpin, Trout, Sediments, Water pollution, Insecticides, Pesticides.

Pacific salmon (Oncorhynchus spp.) have been stocked in the Great Lakes where they accumulate body burdens of chlorinated hydrocarbons. The transport of these contaminants to resident communities in spawning streams was studied in two tributaries of Lake Michigan accessible to anadromous spawners and one control tributary blocked to them. No polychlorinated biphenyls (PCBs), DDT, or dieldrin was detected in the sediments or biota of the control stream, or in sediments of the test streams. However, trout (Salmo spp.) and, to a lesser extent, sculpins (Cottus spp.) accumulated PCBs and DDT by eating contaminated salmon eggs. Eggs constituted as much as 87% by weight of the total stomach contents of trout collected during the salmon spawning season between early October and early January. Salmon eggs contained 0.46-9.50 mg PCBs/kg, and 0.14-1.80 mg DDT/kg. Consumption of eggs varied greatly among individual trout, and there was a strong correlation between numbers of eggs in the stomachs and PCB and DDT concentrations in the fillets. It is concluded that the evidence strongly supports hydrocarbon contamination of resident stream trout by spawning salmon in Great Lakes tributaries. (Author's abstract)
W87-08042

PERIPHYTON AS MONITORS FOR HEAVY METAL POLLUTION IN THE CALCASIEU RIVER ESTUARY,
McNeese State Univ., Lake Charles, LA. Dept. of Chemistry.
G. J. Ramelow, R. S. Maples, R. L. Thompson, C. S. Mueller, and C. Webre.
Environmental Pollution, Vol. 43, No. 4, p 247-261, April 1987. 3 fig, 2 tab, 15 ref. DOE Grant DE-FG01-83EP31111.

Descriptors: *Limnology, *Periphyton, *Bioindicators, *Heavy metals, *Path of pollutants, *Calcasieu River, *Estuaries, Sediments, Metals, Pollutants, Copper, Lead, Chromium, Zinc, Cadmium, Arsenic, Silver.

The levels of copper, lead, chromium, zinc, cadmium, arsenic and silver were determined in periphyton specimens obtained with a diatometer collector. Stations selected were along three important bayous of the Calcasieu River system. Distributions of some metals in the organisms were similar to those found in sediment from the same locations, while other metals appeared to be similar to water concentrations. Concentration ratios of periphyton over sediment greatly exceeded one for the metals chromium, zinc, cadmium, arsenic and silver. The concentrations of heavy metals in the periphyton appeared to yield more information about pollutants than either water or sediment samples collected at the periphyton stations. (Author's abstract)
W87-08055

LEAD CONCENTRATIONS IN SOIL, SEDIMENT AND CLAM SAMPLES FROM THE PUNGO RIVER PEATLAND AREA OF NORTH CAROLINA, USA,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
C. B. Pace, and R. T. Di Giulio.
Environmental Pollution, Vol. 43, No. 4, p 301-311, April 1987. 3 tab, 24 ref.

Descriptors: *Limnology, *Path of pollutants, *Lead, *Sediments, *Clams, *Pungo River, *Peatlands, Drainage, Canals, Tissue analysis, Bioavailability, North Carolina.

Lead (Pb) concentrations were measured in samples of peat soils, sediments and clams (Rangia cuneata) collected from the Pungo River region of coastal North Carolina. In peat soils, mean Pb concentrations (dry weight + or SD) were significantly higher ($p < 0.05$) in surface samples (12.8 microgram(ug)/g + or - 7.6) than in samples from depths of 20 cm (2.7 ug/g + or - 2.7) or 1 m (3.6 ug/g + or - 3.6). Mean Pb concentrations in surface sediments from canals draining peatlands and from the Pungo River which receives this drainage ranged from 0.1 ug/g + or - 0.1 to 7.0 ug/g + or - 0.6. These Pb concentrations are similar to values reported in other studies for areas considered uncontaminated. Fractionation analyses revealed that the majority of the Pb in the peat and sediment samples was associated with the residual fraction, with lesser amounts in the organically-bound fraction, and generally negligible amounts in the water-soluble fraction. These results indicate that the bulk of the Pb in the soils and sediments of this area is relatively immobile and non-bioavailable. This is supported by the relatively low concentrations of Pb (0.2-0.5 ug/g, dry weight) observed in soft tissues of R. cuneata collected from the Pungo River. (Author's abstract)
W87-08058

MERCURY LEVELS IN ONTARIO MINK AND OTTER RELATIVE TO FOOD LEVELS AND ENVIRONMENTAL ACIDIFICATION,
Toronto Univ. (Ontario). Inst. for Environmental Studies.
C. D. Wren, P. M. Stokes, and K. L. Fischer.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 12, p 2854-2859, December 1986. 4 tab, 37 ref.

Descriptors: *Bioindicators, *Tissue analysis, *Mercury, *Mink, *Otter, *Food chains, *Path of pollutants, *Acidification, Ontario, Heavy metals, Selenium, Predation, Fish, Metals.

Tissue mercury levels were determined in 94 mink and 84 otter collected from five study areas in Ontario during the 1983-1984 and 1984-1985 trapping seasons. The level of Hg in tissues of both mink and otter followed the order of liver, kidney > muscle > brain. There was no observed relationship between age, sex or selenium content and tissue Hg levels in mink or otter within a study area. Tissue Hg levels in mink and otter were significantly different among locations. For example, the mean Hg concentrations in mink liver from the English River, Turkey Lakes, Muskoka, Sudbury, and Cambridge areas were 2.55, 2.36, 2.17, 0.56, and 0.14 microgram/g, respectively. Mercury levels in fish and crayfish from the study areas followed a similar pattern. Mink and otters are therefore, sensitive bioindicators of environmental Hg levels. The results contradict the general hypothesis of elevated Hg levels in biota from acid-stressed ecosystems, and suggest that environmental variables other than pH play a major role in governing biotic metal levels. (Author's abstract)
W87-08062

DERIVATIVES OF DICYCLOPENTADIENE IN GROUND WATER,
Johns Hopkins Univ., Baltimore, MD. School of Medicine.
For primary bibliographic entry see Field 5A.
W87-08063

POTABLE WATER AS A SOURCE OF AIRBORNE 222RN IN U.S. DWELLINGS: A REVIEW AND ASSESSMENT,
California Univ., Berkeley. Lawrence Berkeley Lab.
W. W. Nazaroff, S. M. Doyle, A. V. Nero, and R. G. Sextro.
Health Physics HLTPAO, Vol. 52, No. 3, p 281-295, March 1987. 6 fig, 4 tab, 58 ref, append. EPA Interagency agreement DW89930801-01-0, DOE Contract DE-AC03-76SF00098.

Descriptors: *Radon isotopes, *Reviews, *Air pollution, *Path of pollutants, *Air pollution sources, *Potable water, *Model studies, Public health, Wells, Drinking water, Water supply, Groundwater.

Using a long-term-average, single-cell model and available data for U.S. housing, the concentration of 222Rn in indoor air due to the use of potable water is assessed. The ratio of the airborne 222Rn concentration to the concentration in water is represented by a lognormal distribution with geometric mean and geometric standard deviation of 0.000065 and 2.88, respectively, in fair agreement with the previously reported results of direct measurements of the ratio in 13 houses. By combining this result with data on 222Rn concentrations in U.S. water supplies, potable water is estimated to contribute an average of 24, 1.3, and 0.1 Bq/cu m to the airborne 222Rn concentration in residences served by private wells, public groundwater, and surface water supplies, respectively. (Author's abstract)
W87-08067

GROUND-WATER CONCENTRATIONS OF 226RA AND 222RN IN NORTH CAROLINA PHOSPHATE LANDS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. E. Watson, and B. F. Mitsch.
Health Physics HLTPAO, Vol. 52, No. 3, p 361-365, March 1987. 3 fig, 2 tab, 9 ref.

Descriptors: *Water pollution sources, *Groundwater quality, *Radium isotopes, *Radon isotopes, *Phosphates, *North Carolina, *Groundwater, Wells, Public health, Radioactivity, Geology, Aquifers, Phosphate mining, Radionuclides.

The groundwater concentrations of 226Ra and 222Rn observed in North Carolina phosphate lands are relatively low. There does not appear to be any need for concern about a health risk, due to these radionuclides, from ingesting groundwater in this area. There were no apparent changes in 226Ra and 222Rn concentrations in groundwater sampled from the same wells at different times. Also, wells sampled in the same locality and at the same depth exhibited uniform concentrations of 226Ra and 222Rn. These observations demonstrate that the radionuclide concentrations are a function of the geology of the area. The highest concentrations of 226Ra and 222Rn in groundwater were found in the Yorktown and surficial aquifers. The reason for this appears to be the natural occurrence of radionuclides in the respective geologic formations. The 226Ra and 222Rn concentrations in water taken from the Castle Hayne aquifer were lower. There is no evidence of an impact on the Castle Hayne aquifer from in-leakage due to phosphate mining operations. However, since baseline data for 226Ra and 222Rn were not obtained before mining operations, a small impact can not be ruled out. The data obtained in this study provide a base line which can be used to evaluate possible future changes. It is recommended that periodic sampling of the research and mining wells be conducted to continue to evaluate possible trends in radionuclide concentrations over time. (Alexander-PTT)
W87-08069

PENETRATION OF NITRATE FROM AGRICULTURAL SOILS INTO THE GROUNDWATER OF THE NORFOLK CHALK,
J. M. Parker, S. K. Booth, and S. S. D. Foster.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 83, Part 2, p 15-32, March 1987. 11 fig, 8 ref.

Descriptors: *Leachates, *Aquifers, *Groundwater pollution, *Path of pollutants, *Nitrates, *Agricultural lands, Norfolk Chalk, Groundwater, Catchments, Recharge, Denitrification.

Diffuse pollution of British aquifers, especially by nitrate leached from agricultural soils, continues to give cause for national concern. Detailed studies of nitrate penetration into four groundwater catchments to public water supply boreholes in the Norfolk Chalk are described. Most groundwater is abstracted from the unconfined parts of the aquifer and has elevated nitrate concentrations, which often already exceed the World Health Organization and European Economic Community recommended limit of 11.3 mg NO3-N liter (50 mg NO3/liter). Stratification of groundwater quality is evident, and it is concluded that nitrate concentrations are likely to continue to rise for many years. In contrast, the groundwater of the extensive semi-confined Chalk aquifer contains little or no nitrate. In spite of evidence of recharge to this aquifer from agricultural soils, these low-nitrate groundwater resources appear secure, as in situ bacteriological denitrification has been demonstrated. There is potential to exploit these resources in their own right and for blending with high-nitrate groundwater supplies. This and other implications for groundwater quality management are discussed. (Author's abstract)
W87-08075

ESTIMATION OF DILUTION IN BUOYANT EFFLUENTS DISCHARGED INTO A CURRENT,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
For primary bibliographic entry see Field 5E.
W87-08077

AIRBORNE MULTISPECTRAL SCANNER DATA FOR ESTIMATION OF DYE DISPERSION FROM SEA OUTFALLS,
Sheffield Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W87-08078

MERCURY CONTENT OF SHRIMP (PENAEUS VANNAMED) REARED IN A WASTEWATER-SEAWATER AQUACULTURAL SYSTEM,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
M. Landau, and R. Pierce.
The Progressive Fish Culturist PFCUAY, Vol. 48, No. 4, p 296-300, October 1986. 3 fig, 17 ref. NSF Grant DAR-8023060.

Descriptors: *Shrimp, *Mercury, *Bioaccumulation, *Aquaculture, *Impaired water use, *Water reuse, *Path of pollutants, *Fisheries, Tissue analysis, Wastewater, Seawater, Ponds, Sediments, Heavy metals.

Penaeus vannamei were reared in two ponds, one receiving 10% wastewater in seawater and no feed, and the other receiving only seawater and a prepared commercial feed. The pond receiving the wastewater had significantly more mercury in the sediment, yet shrimp in this pond did not accumulate significant amounts of the mercury in their edible tissue. (Author's abstract)
W87-08115

POTENTIAL FOR NITROSAMINE FORMATION IN SEVEN FISHERY CHEMICALS,
National Fishery Research Lab., La Crosse, WI.
S. L. Abidi, V. K. Dawson, and R. C. Hubley.
The Progressive Fish Culturist PFCUAY, Vol. 48, No. 4, p 301-302, October 1986. 1 tab, 6 ref.

Descriptors: *Nitrosamines, *Fishery chemicals, *Water pollution sources, *Chemical reactions, Carcinogens, Mutagens, Fisheries, Organic compounds, Dyes, Tracers, Amines, Nitrites.

In recent years, nitrosamines have been reported as possible causes of cancer, mutations, or birth defects. Inasmuch as these compounds may be formed by the interaction of certain amines with nitrite in the aquatic environment, seven fishery chemicals were evaluated for their potential to form nitrosamines: the experimental fish toxicant digeranylethanolamine (GD-174); the four therapeutants Terramycin, erythromycin, Hyamine 1622, and Hyamine 3500; and the two tracer dyes rhodamine B and rhodamine WT. The results indicate that the controlled use of the seven fishery chemicals in natural environments will not lead to the formation of nitrosamines. (Author's abstract)
W87-08116

FIELD STUDY OF SCALE-DEPENDENT DISPERSION IN A SANDY AQUIFER,
Toronto Univ. (Ontario). Groundwater Research Group.
S. R. Taylor, and K. W. F. Howard.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 11-17, March 1987. 3 fig, 1 tab, 14 ref.

Descriptors: *Groundwater movement, *Dispersion, *Field tests, *Sandy aquifers, *Tracers, *Path of pollutants, Unconfined aquifers, Aquifers, Solute transport, Solutes, Transport, Pollutants, Prediction.

The relationship between the magnitude of dispersivity and its scale of measurement was investigated in an unconfined sand aquifer using an innovative 40-m natural-gradient tracer test. Although most previous studies have indicated that the value for dispersivity is dependent upon the scale of measurement, the results of this study clearly demonstrate the absence of a distance-dependent relationship. A mean longitudinal-dispersivity value of 0.016 m was found to be representative of the entire aquifer. These findings have important implications for predicting the fate of contaminants in groundwater systems. (Author's abstract)
W87-08118

SOLUTE TRANSPORT WITH EQUILIBRIUM AQUEOUS COMPLEXATION AND EITHER SORPTION OR ION EXCHANGE: SIMULATION METHODOLOGY AND APPLICATIONS,
Geological Survey, Reston, VA.
F. M. Lewis, C. I. Voss, and J. Rubin.
Journal of Hydrology JHYDA7, Vol. 90, No. 1/2, p 81-115, March 1987. 17 fig, 19 ref, append.

Descriptors: *Path of pollutants, *Solute transport, *Model studies, *Sorption, *Ion exchange, *Complexation, *Simulation analysis, Chemical reactions, Dispersion, Porous media, Simulation, Solutes, Transport, Pollutants, Flow.

Methodologies that account for specific types of chemical reactions in the simulation of solute transport can be developed so they are compatible with solution algorithms employed in existing transport codes. This enables the simulation of reactive transport in complex multidimensional flow regimes, and provides a means for existing codes to account for some of the fundamental chemical processes that occur among transported solutes. Two equilibrium-controlled reaction systems demonstrate a methodology for accommodating chemical interaction into models of solute transport. One system involves the sorption of a given chemical species, as well as to aqueous complexations in which the sorbing species is a participant. The other reaction set involves binary ion exchange coupled with aqueous complexation involving one of the exchanging species. The methodology accommodates these reaction systems through the addition of nonlinear terms to the transport equations for the sorbing species. Example simulation results show (1) the effect equilibrium chemical parameters have on the spatial distributions of concentration for complexing solutes; (2) that an interrelationship exists between mechanical dispersion and the various reaction processes; (3) that dispersive parameters of the porous media cannot be determined from reactive concentration distributions unless the reaction is accounted for or the influence of the reaction is negligible; (4) how the concentration of a chemical species may be significantly affected by its participation in an aqueous complex with a second species which also sorbs; and (5) that these coupled chemical processes influencing reactive transport can be demonstrated in two-dimensional flow regimes. (Author's abstract)
W87-08122

STUDY OF THERMOPHILIC CAMPYLOBACTERS IN A RIVER SYSTEM,
Preston Infirmary, (England).
F. J. Bolton, D. Coates, D. N. Hutchinson, and A. F. Godfree.
Journal of Applied Bacteriology JABAA4, Vol. 62, No. 2, p 167-176, February 1987. 3 fig, 4 tab, 29 ref.

Descriptors: *Path of pollutants, *Water pollution sources, *Pathogenic bacteria, *Bacteria, *River systems, *Thermophilic bacteria, *Campylobacter, *Limnology, *Isolation, Effluents, Rural areas, Urban areas, Flow velocity, Seasonal variation, Species composition.

Fifteen kilometers of a river system traversing rural and urban areas and subject to sewage works effluent discharge was studied during a 12 1/2 month period. A total of 312 samples was collected from 12 sites at 14 d intervals and tested by a glass microfiber filtration method and a most probable number (MPN) method. Campylobacters were found in 43% of samples by the filtration method and 21% by the MPN method. The lowest frequency of isolation and lowest counts (<10 campylobacters/100 ml) were associated with samples collected from rural sites and fast-flowing stretches of river. The greatest frequency of isolation and highest counts (>10-230 campylobacters/100 ml) were associated with sites adjacent to or downstream of sewage works. There was an obvious seasonal trend; most isolations and highest counts were obtained in late autumn and winter, and fewest isolations and lowest counts in spring and summer. Surface water runoff from adjacent farmland following heavy rainfall also increased the counts of campylobacters in the river system. Biotyping of isolates demonstrated that the most prevalent Campylobacter sp. was Campylobacter jejuni but C. coli, C. laridis and a previously unrecognized group of campylobacters were also isolated. Serotyping differentiated 14 serotypes of C. jejuni, 11 of C. coli and two of C. laridis. Furthermore, serotypes of C. jejuni commonly isolated from enteritis in man were frequently found in river water tested during this study. (Author's abstract)
W87-08127

COMMUNITY HOSPITAL OUTBREAK OF LEGIONELLOSIS: TRANSMISSION BY POTABLE HOT WATER,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 5C.
W87-08136

PATHOGEN REMOVAL FROM WASTEWATER DURING GROUNDWATER RECHARGE,
Arizona Univ., Tucson. Dept. of Microbiology.
For primary bibliographic entry see Field 5D.
W87-08146

PROCESSES AFFECTING THE MOVEMENT AND FATE OF TRACE ORGANICS IN THE SUBSURFACE ENVIRONMENT,
Stanford Univ., CA. Dept. of Civil Engineering.
P. L. McCarty, B. E. Rittmann, and M. Reinhard.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 627-646, 9 fig, 4 tab, 14 ref. EPA Grant EPA R-804431.

Descriptors: *Water reuse, *Artificial recharge, *Path of pollutants, *Fate of pollutants, *Groundwater pollution, *Palo Alto, *California, Injection, Aquifers, Groundwater recharge, Organic compounds.

Organic contaminants reach the subsurface environment when reclaimed waters are percolated through the soil surface or injected into aquifers either for groundwater replenishment or wastewater treatment. Organic materials may also pass into the subsurface environment after transport and handling accidents or through leakage from storage facilities. Questions concerning the movement, transformation, and ultimate fate of trace organic materials need to be answered in order to assess the risks of contamination of potable groundwater supplies by hazardous organic pollutants and the feasibility of recharge systems. Questions of importance include: (1) how effectively organic pollutants are removed during travel of water into and through subsurface systems; (2) what the mechanisms of removal or transformation are; (3) what the end products of possible transformations are: and (4) what the speed of transport is of the pollutants with respect to that of the water with which they are associated. These questions on the behavior of organic pollutants are being addressed through a research project associated with the 0.088 cu m/sec (2 million gal/day) Palo Alto water reclamation facility, which is operated by the Santa Clara Valley Water District, California, and supplies water for a groundwater injection system. Basic laboratory studies are also being conducted in order to interpret the field data in a way that permits drawing general conclusions having applicabillity elsewhere. Two phenomena that are of importance in the transporation and fate of organic pollutants in a subsurface system are adsorption and biodecomposition. Factors affecting these phenomena are presented in this paper, and their relevance to evaluating the behavior of organic materials is discussed. (See also W87-08137) (Lantz-PTT)
W87-08159

FIELD OBSERVATIONS OF ORGANIC CONTAMINANT BEHAVIOR IN THE PALO ALTO BAYLANDS,
Stanford Univ., CA. Dept. of Civil Engineering.
P. V. Roberts.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 647-679, 18 fig, 8 tab, 19 ref. EPA Grant R-804431.

Descriptors: *Fate of pollutants, *Water reuse, *Artificial recharge, *Path of pollutants, *Palo Alto, *California, *Groundwater pollution, Groundwater recharge, Biodegradation, Total organic carbon, Chemical oxygen demand, Chlorobenzene, Organic compounds.

The concentrations of organic constituents are affected by processes such as sorption and biodegradation during groundwater recharge with reclaimed water, even where the recharged water has received advanced treatment including granular activated carbon. The influence of sorption is observed as retardation of the transport of trace organics compounds, which are retained to varying degrees in the aquifer. The effects of biodegradation are evidenced by decreasing concentrations of TOC, COD, and dissolved oxygen as the water spreads out from the injection point. Generally, the concentrations of TOC and COD respond rapidly to fluctuations in input concentraation, indicating that the bulk of organic constituents in the reclaimed water does not engage in sorptive interactions with the aquifer material. Surprisingly, halogenated organic compounds measured by TOC show no evidence of retardation or retention during aquifer passage. The sequential breakthrough of trace organic contaminants is believed to be caused by differing strengths of sorption on the aquifer material. Retardation factors estimated for this field site range from a value of three for chloroform to 35 for chlorobenzene. The organic pollutants remaining after water reclamation treatment pose a potential health threat if the reclaimed water is to be directed to potable reuse. Groundwater recharge by direct injection affords protection against this risk by affording opportunities for adsorption and degradation and by smoothing concentration fluctuations. Nonetheless, some organic pollutants do penetrate through both water reclamation and groundwater recharge, moving with approximately the same velocity as the recharged water toward points of eventual extraction or reuse. The methodology described and the results presented here are believed to be applicable for situations other than groundwater recharge by direct injection. The transport rates and fates of organic contaminants are of importance in evaluating the health risks of groundwater pollution regardless of its source. Organic contaminants may enter groundwater other than by direct injection: for example, as a result of spills, sanitary landfills, agricultural practices, land treatment of wastewater, or by surface-spreading recharge. Upon reaching the groundwater zone, the pollutants so introduced are likely to be influenced by the processes found in this work to be important, namely sorption and degradation. (See also W87-08137) (Lantz-PTT)
W87-08160

DEVELOPMENT OF MULTIMEDIA ENVIRONMENTAL GOALS FOR POLLUTANTS IN SOLID WASTES AND LEACHATES,
Research Triangle Inst., Research Triangle Park, NC.
For primary bibliographic entry see Field 5E.
W87-08173

CORRELATIONS OF PHYSICAL AND CHEMICAL PROPERTIES OF COMPOUNDS WITH THEIR TOXICITIES AND DISTRIBUTIONS IN THE ENVIRONMENT,
Dow Chemical Co., Midland, MI. Dept. Health and Environmental Sciences.
E. E. Kenaga.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 105-119, 3 tab, 22 ref.

Descriptors: *Physical properties, *Chemical properties, *Toxicity, *Fate of pollutants, *Environmental effects, Regression analysis, Distribution patterns, Biological magnifications.

A detailed study of the environmental fate and toxicity of a chemical is necessary for persistent, toxic chemicals that bioconcentrate and that are widely distributed in the environment in significant volume. Few chemicals meet all these qualifications. Since such studies are expensive and time-consuming, only those tests that are necessary for good hazard evaluation under the expected use and distribution conditions of the specific chemical being evaluated should be conducted. From a growing background of information on comparative toxicology and fate of chemicals in the environment, there are now many useful early stage evaluation and predictive techniques. Predictive regression equations for physical and chemical properties and toxicology of chemicals allow calculation or estimation of distribution coefficients in air, water, soil, and organisms. Other correlations include comparative species toxicity and bioconcentration factors. Chemical structure and chemical and physical properties are useful for limited prediction of chronic-acute toxicity ratios (application factors). (See also W87-08166) (Author's abstract)
W87-08175

OCCURRENCE AND MIGRATION OF CONTAMINANTS IN GROUNDWATER AT MUNICIPAL LANDFILLS ON SAND AQUIFERS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
J. A. Cherry.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 127-147, 6 fig, 1 tab, 17 ref.

Descriptors: *Path of pollutants, *Groundwater pollution, *Municipal wastes, *Landfills, *Aquifers, Leachates, Plumes, Piezometry, Chlorine, Sodium, Magnesium, Calcium, Ammonium, Iron, Manganese, Alkalinity, Nitrites, Sulfates.

Plumes of leachate-contaminated groundwater at three municipal landfills on unconfined sand aquifers have been monitored using networks of multilevel piezometers. The landfills range in age from 15 to 42 years and in area from 4 to 28 ha. The plumes extend over distances ranging from 0.6 to 0.8 km from the landfills, and they occupy much of the vertical thickness of the sand aquifers, except toward the fronts of the plumes where the zones of contamination are much thinner. The concentrations of major contaminants in the plumes decline gradually in the direction of groundwater flow. At two of the sites, distinct vertical zones of contaminated and relatively uncontaminated groundwater persist over large distances in the plumes, which suggests that vertical dispersion does not cause strong vertical mixing. The concentrations of Cl(-), Na(+), Mg(2+), Ca(2+), NH4(+), Fe, Mn, alkalinity, and total dissolved solids in the plumes are considerably above background levels and have spatial distribution patterns with generally similar trends. Because of reducing redox conditions in the landfills and the anoxic status of the plumes, NO3(-) and SO4(2-) occur at very low concentrations. An exception occurs at one of the sites where SO4(2-), which is apparently leached from the building demolition debris that contains gypsum and that is abundant in this landfill, is a major constituent in the plume. None of the plumes contain toxic inorganic constituents at levels above the limits specified in the primary drinking water standards. Dissolved organic carbon and organic nitrogen exist at above-background levels throughout the plumes, which indicates that some types of organic compounds are very mobile in the groundwater system. (See also W87-08166) (Author's abstract)
W87-08176

GEOCHEMISTRY AND SUBSURFACE CHARACTERIZATION RELATED TO THE TRANSPORT AND FATE OF INORGANIC CONTAMINANTS,
Oklahoma State Univ., Stillwater. Dept. of Geology.
A. W. Hounslow.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 149-159, 21 ref.

Descriptors: *Geochemistry, *Path of pollutants, *Groundwater pollution, Groundwater movement, Fate of pollutants, Groundwater quality, Heavy metals, Sorption, Hydrogen ion concentration, Salinity.

The movement and attenuation of heavy metal pollutants in the subsurface depends primarily on groundwater movement and the sorptive properties of the subsurface solids. The principal sorbents are hydrous oxides of iron and manganese, insoluble organic matter, and clay minerals, frequently in that order of importance. They form primarily in soils as a result of weathering but are sufficiently transitory to occur in the underlying sediments. They may influence the porosity of the subsurface medium, and their mode of occurrence depends on the geochemical environment in which they formed, which may affect their sorptive properties. Groundwater quality results from the interaction of water with the rocks through which it moves. Groundwater composition changes as the geochemistry of the environment changes. The sorption of heavy metals depends both on the geochemical environment and the form of the sorbent (i.e., whether it is a single phase or a multiphase complex of several materials). Heavy metals may be desorbed and mobilized by high salt concentrations, changes in pH and redox potential, an influx of natural or synthetic complexing agency or microbial formation of soluble and toxic alkyl derivatives of heavy metals. (See also W87-08166) (Author's abstract)
W87-08177

CORRELATIONS OF COMPOUND PROPERTIES WITH SORPTION CHARACTERISTICS OF NONPOLAR COMPOUNDS BY SOILS AND SEDIMENTS: CONCEPTS AND LIMITATIONS,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
J. J. Hassett, W. L. Banwart, and R. A. Griffin.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 161-178, 3 fig, 3 tab, 27 ref. EPA Grants R-804684 and R-808417.

Descriptors: *Sorption, *Soil contamination, *Sediments, *Organic compounds, *Path of pollutants, Organic carbon, Solubility, Regression analysis, Adsorption, Organic matter.

Sorption constants for the sorption of nonpolar (hydrophobic) organic compounds are highly correlated with the organic carbon content of the sorbing phase (soil or sediment) and with water solubility and the octanol-water partition coefficient of the compound. The purposes of this chapter are: (1) to review and expand the concept of hydrophobic sorption; (2) to show the relationships between molar Freundlich adsorption constants and soil, and sediment organic carbon contents; (3) to develop regression equations relating sorption to the organic compounds water solubilities and octanol-water partition coefficients; and (4) to discuss the use and limitations of these concepts. Several conclusions are apparent. The adsorption of hydrophobic nonpolar organic compounds by soils is a function of the organic matter content of the soil. Individual adsorption constants average on a common value, K sub oc, when adjusted for the soil organic carbon content. Values of K sub oc, were negatively correlated with the water solubility (S) and were positively correlated with the n-octanol/water partition coefficient (K sub ow). The relations correlating K sub ow and S data with K sub oc offer powerful tools for making predictions of the K sub oc values of nonpolar organics by soils; K sub oc values can also be used to predict sorption on individual soils if organic contents of the soil materials are known. Although these relationships offer the potential for prediction of sorption from simple physicochemical properties, they do not preclude the need for experimental verification of predictions. (See also W87-08166) (Lantz-PTT)
W87-08178

FOOD CHAIN PATHWAYS FOR TOXIC METALS AND TOXIC ORGANICS IN WASTES,
Agricultural Research Service, Beltsville, MD. Biological Waste Management and Organic Resources Lab.
R. L. Chaney.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 179-208, 1 tab, 172 ref. EPA.

Descriptors: *Fate of pollutants, *Path of pollutants, *Waste disposal, *Food chains, *Organic compounds, Toxicity, Heavy metals, Phytotoxicity, Land disposal.

Pathways to and potential effects on the food chain of microelements and toxic organic compounds in wastes applied to land treatment sites are considered in detail. Wasteborne toxic chemicals can enter the food chain in: (1) ingested wastes, wastes adhering to forages, or waste-amended soil; or (2) plants that have increased levels of the toxic chemical when grown on waste-amended soil. Some wasteborne elements fail to injure animals even when the waste is ingested (e.g., Ti, Cr(3+), Zr, Si, Sn, Au, Ag), either because animals tolerate high exposures or because the element is bound very strongly by the ingested soil or waste. Other chemicals can injure animals that ingest the waste or soil but not when animals ingest plants grown on the amended soil (Fe, Pb, Ni, Zn, Cu, Be, As and bioaccumulated toxic organic compounds) because phytotoxicity kills the plant before the metal concentration in the plant reaches toxic levels for the animal. On the other hand, risk may result from ingestion of forage crops that contain phytotoxic levels of Co or excessive nonphytotoxic levels of Se, Mo, or Cd. Cumulative applications of only a few elements (Cd and Pb) must be restricted to protect humans from worst-case situations. If land treatment sites were not allowed to be converted to normal, unregulated land-use patterns until toxic organic compounds were degraded, management practices that avoided adverse food-chain effects could be developed for nearly any organic waste. (See also W87-08166) (Author's abstract)
W87-08179

SIMULATION STUDY OF THE VOLATILIZATION OF POLYCHLORINATED BIPHENYLS FROM LANDFILL DISPOSAL SITES,
Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
C. Springer, L. J. Thibodeaux, and S. Chatrathi.

IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 209-222, 7 fig, 8 tab, 5 ref.

Descriptors: *Simulation analysis, *Volatilization, *Polychlorinated biphenyls, *Landfills, *Path of pollutants, *Waste disposal, Disposal sites, *Model studies, Biodegradation, Computer programs.

Computer simulation studies were made of the emission of polychlorinated biphenyls from landfill disposal sites. The model included mechanisms for the migration of vapor through the landfill covering (cap) by: (1) diffusion within the pore spaces, (2) barometric pressure pumping because of fluctuating barometric pressure; and (3) sweeping flow of gases produced by biodegradation of other waste materials. Increased cap depth and decrease cap porosity have the expected result on the vapor emission rate in the absence of biologically produced sweep gas, but the emission rate is approximately proportional to the rate of gas production. The vapor emission rate of polychlorinated biphenyls from landfills may be expected to be quite low in any event, but the accompanying deposition of biodegradable materials may have undesirable results caused by the formation of gases from biological decomposition processes. (See also W87-08166) (Author's abstract)
W87-08180

MULTIMEDIA MODELING OF TRANSPORT AND TRANSFORMATION OF CONTAMINANTS,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
J. W. Falco, L. A. Mulkey, and J. Schaum.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 223-238, 3 fig, 1 tab, 9 ref.

Descriptors: *Path of pollutants, *Model studies, *Fate of pollutants, Solid wastes, Waste disposal, Landfills, Spatial distribution, Temporal distribution.

Passage of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Compensation and Liability Act has focused research efforts on environmental problems associated with the disposal of solid wastes. Methods for predicting human and environmental exposure to chemicals disposed of in landfills are being investigated. Multimedia models for predicting environmental concentrations are being developed to provide a means of estimating environmental concentrations of substances released into the environment from landfills. The role of multimedia models in estimating exposure to pollutants released from landfills is defined in this chapter. Major issues addressed include optimization of temporal and spatial scales of application in each medium, and data requirements to calibrate and use the components of exposure assessment. Major research gaps that must be addressed to improve exposure estimates are: (1) lack of knowledge of chemical transformation pathways and rates within the landfill and groundwater; (2) validation and testing of existing multimedia models; and (3) linkage of these models with other analyses required to estimate exposure. (See also W87-08166) (Author's abstract)
W87-08181

SUBSURFACE HYDROLOGIC MONITORING TO EVALUATE CONTAMINANT MIGRATION: REQUIREMENTS AND SOLUTIONS,
Battelle Pacific Northwest Labs., Richland, WA.
R. W. Nelson, and W. A. Rice.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 305-314, 4 fig, 9 ref.

Descriptors: *Monitoring, *Groundwater pollution, *Path of pollutants, Solid wastes, Waste disposal, Chemical analysis, Groundwater movement.

Providing adequate subsurface monitoring for solid waste treatment and disposal facilities involves various commplexities, many of which result from the diversity of the waste forms and the geologic and hydrologic settings encountered. An adequate, cost-effective evaluation of groundwater quality under such diverse conditions requires coordination of many technical disciplines and analytic methods. This emphasis on planning and continuing reevaluation of monitoring objectives is not meant to detract from technical considerations of monitoring. Such factors include constructing and installing hydrologic sampling devices, obtaining realistic samples with the field-sampling structures, obtaining in-place measurements to supplement and enhance later laboratory analysis, preserving samples, providing accurate analytical measurements, checking measured results for consistency, and reporting and recording data results for historical records. These and other technical aspects must be incorporated into the planning, organizing, and continued updating of subsurface monitoring efforts. This chapter considers the relationship of monitoring and the more detailed subsurface environmental performance assessments; (2) shows how subsurface monitoring is best planned and organized within the framework of the overall environmental performance assessment objectives; and (3) explains the requirements and background needed for environmental evaluations of solid waste treatment facilities and disposal sites. (See also W87-08166) (Lantz-PTT)
W87-08186

CHEMICAL INDICATORS OF LEACHATE CONTAMINATION IN GROUNDWATER NEAR MUNICIPAL LANDFILLS,
Geraghty and Miller, Inc., Syosset, NY.
R. A. Saar, and O. C. Braids.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 315-328, 1 fig, 2 tab, 14 ref.

Descriptors: *Chemical analysis, *Leachates, *Groundwater pollution, *Tracers, *Landfills, *Fate of pollutants, *Municipal wastes, *Path of pollutants, Specific conductivity, Ammonium, Chlorides, Bicarbonates, Iron, Potassium, Sulfates, Water analysis.

To investigate the impact of a municipal landfill on groundwater, water samples from nearby observation wells can be tested for leachate indicators. Chemical results from such investigations may be difficult to interpret because leachate production varies with time and place, soils attenuate some chemicals more than others, and problems of sampling and analysis may introduce errors into the data set. The following easily measured constituents have been found to be most helpful in distinguishing groundwater contaminated by leachate from that which is not: specific conductance, ammonium, chloride, bicarbonate, iron, potassium, and sulfate (as an inverse indicator). The reliability of data can be assessed in part by determining if contradictions exist in a data set through the use of interrelated analyses. Replicates and spiked samples can help to monitor sampling and laboratory performance. (See also W87-08166) (Author's abstract)
W87-08187

MONITORING OF SOLID WASTE DISPOSAL SITES: WHAT FACTORS ARE RELEVANT FOR ELECTRIC UTILITIES,
Little (Arthur D.), Inc., Cambridge, MA.
C. J. Santhanam, and D. E. Kleinschmidt.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 329-341, 1 fig, 2 tab, 4 ref.

Descriptors: *Monitoring, *Solid wastes, *Disposal sites, *Electric powerplants, *Waste disposal, Data interpretation, Sampling, Chemical analysis, Physical analysis.

Briefly discussed are the general methodologies for monitoring solid waste disposal sites for coal-fired electric utilities. An effective monitoring program should result in assessment of environmental effects and soundness of disposal method. It should include site evaluation, site development for monitoring, sampling and analysis, and assessment of generated data. So that data generated by site monitoring can be used as a management tool, they should be tied to an environmental assessment effort to determine the soundness of the disposal method and, if appropriate, to make general projections. The following sequence is commonly practiced: (1) Validated results from the disposal site are compiled in an appropriate format; (2) Once the validated basis of information for that particular mix of disposal method, waste characteristics, and site conditions (including background information) is obtained, the next step is to develop an understanding combination of site conditions, method of disposal, and waste characteristics; (3) Cause-and-effect relationships for the physical and chemical sampling and analysis results are assessed on the basis of steps 1 and 2 previously mentioned; and (4) The last step is to make generic projections of the implications of the effects of this particular mix of waste characteristics, disposal method and site characeristics to numerous circumstances based on a generic mix of waste types, method of disposal and site conditions. (See also W87-08166) (Lantz-PTT)
W87-08188

MONITORING EXPERIENCES AT A FLUE GAS DESULFURIZATION SLUDGE DISPOSAL SITE: WHAT CAN BE ACHIEVED,
Baker (Michael), Jr., Inc., Beaver, PA.
D. W. Hupe, and D. M. Golden.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 343-357, 2 fig, 4 ref.

Descriptors: *Monitoring, *Sludge, *Waste disposal, *Flue gas desulfurization, *Path of pollutants, Leachates, Industrial wastes, Groundwater pollution, Groundwater quality, Landfills, Leaching, Lysimeters.

Monitoring systems designed to adequately detect potential groundwater contamination can be much more complex than general monitoring schemes illustrated in commonly available guideline literature. In this study, a determination of the effects on groundwater is complicated by background influences that made installation of a complex network of monitoring wells necessary. These influences are related to prior disposal activities at the FGD sludge landfill site and several current power station activities in the immediate area. The effects on groundwater quality from the background influences are very similar to the possible effects from the sludge landfill, which makes differentiation of leachate sources a difficult task. None of the effects from the disposal operations noted during the study caused any concern about U.S. Environmental Protection Agency (EPA) Primary Drinking Water Standards. The primary objective of a groundwater monitoring program is to responsibly monitor for contamination that might be produced as a consequence of disposal activities. However, sufficient monitoring to demonstrate, if necessary, that a site is not responsible for contamination caused by another source is just as important. Several important points can be drawn from the experiences gained during this study: (1) without sufficient background and upgradient monitoring, false conclusions can easily be reached on whether a disposal site is causing groundwater contamination; (2) careful site historical research and attention to day-to-day operations are extremely important because they can significantly affect the design of the monitoring program and later interpretation; (3) regardless of the level of attention to the monitoring program, use of the monitoring wells to

unquestionably determine whether an area's groundwater resources are affected by a solid waste disposal facility may be impossible becuase of background influences; (4) pressure-vacuum lysimeters placed beneath a disposal site in the unsaturated zone before the start of disposal activities may be the only way to adequately monitor under conditions where there is significant background interference such as has been experienced at Conesville. (See also W87-08166) (Lantz-PTT)
W87-08189

APPLICATION OF PATTERN RECOGNITION TO THE EVALUATION OF CONTAMINATION FROM OIL SHALE RETORTING,
Colorado Univ. at Denver. Center for Environmental Sciences.
For primary bibliographic entry see Field 7C.
W87-08191

PRELIMINARY DESIGN FOR A SORBING TRACER TEST IN THE CULEBRA DOLOMITE AT THE H-3 HYDROPAD AT THE WASTE ISOLATION PILOT PLANT (WIPP) SITE,
INTERA Technologies, Inc., Austin, TX.
F. J. Pearson, V. A. Kelley, and J. F. Pickens.
Contract Report No. SAND86-7177, February 1987. 151 p, 19 fig, 21 tab, 60 ref, append. DOE Contract DE-AC04-76DP00789.

Descriptors: *Sorption, *Tracers, *Culebra dolomite, *Waste treatment, *Radioactive wastes, *Groundwater movement, *Simulation analysis, *Path of pollutants, Hydraulic characteristics, Groundwater quality, Tritium, Bromine radioisotopes, Iodine radioisotopes.

The use of sorbing tracers in a field hydrologic test is a method of estimating the nuclide transport characteristics at one location in the Culebra dolomite at the Waste Isolation Pilot Plant (WIPP) site. The Culebra is considered to be the principal continuous pathway from the site in the event of a breach of the planned nuclear-waste repository. The Culebra dolomite at the H-3 hydropad is the recommended site for conducting a sorbing tracer test because: (a) the site has been well-characterized hydraulically in a number of multi-well interference tests; (b) a convergent-flow conservative tracer test has been conducted at the H-3 hydropad, and analyzed to yield estimates of the physical solute-transport parameters (this test identified the role played by fractures in dominating solute-transport behavior at the hydropad scale); (c) a number of high quality groundwater samples have been collected from the culebra at the H-3 site and they have provided analyses with which to assemble a well-understood geochemical characterization; (d) the H-3 site is located down-gradient from the repository site on a probable groundwater flow path under natural gradients; and (e) the H-3 site has appropriate hydraulic characteristics to allow the use of sorbing tracers with a wide range of partition coefficients and provide breakthrough in the allowable tracer test operational period, assumed to be two to five years. Design simulations for the sorbing tracer test were conducted assuming an injection of one kilogram of generic tracer and applying a range of partition coefficients of 0.1 to 50.0 ml/g for the flow path with a higher transport rate, and 0.1 to 10.0 ml/g for the flow path with the lower transport rate, at the H-3 hydropad. The results of these simulations were utilized to assist in the selection of sorbing tracers that would break through within the two- to five-year period planned for the test. Radionuclide tracers most suitable for use as a sorbing tracer are either fission-products or actinides. (Lantz-PTT)
W87-08199

EVALUATION OF SEPTIC TANK SYSTEM EFFECTS ON GROUND WATER QUALITY,
National Center for Ground Water Research, Norman, OK.
L. Canter, and R. C. Knox.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-244441. Price codes: A17 in paper copy, A01 in microfiche. EPA Report No. EPA-600/2-84-107, June 1984. 381 p, 27 fig, 53 tab, 122 ref, 5 append. EPA Cooperative agreement CR-806931.

Descriptors: *Septic tanks, *Groundwater quality, *Water pollution sources, *Wastewater disposal, *Groundwater pollution, Path of pollutants, Wastewater disposal, Organic compounds, Flow patterns, Model studies.

Summarized is the literature concerning the types and mechanisms of groundwater pollution from septic tank systems and information on methodologies for evaluating the groundwater pollution potential. The conclusions are: (1) septic tank systems represent a significant source of groundwater pollution in the United States since many systems are exceeding their design life, the usage of synthetic organic chemicals in the household is increasing, and larger-scale systems are being designed and used; (2) a key issue is related to understanding the transport and fate of system effluents in the subsurface environment; (3) no specific technical methodology exists for evaluting groundwater effects of septic tank systems, however, application of two empirical assessment methodologies (surface impoundment assessment and waste-soil-site interaction matrix) adjusted for annual wastewater flow and analytical method for determining water table rise, and a solute-transport model for groundwater flow and pollutant concentrations has met with some success; and (4) the empirical assessment methodology (adjusted SIA method) could be used in permitting or evaluation procedures for systems serving individual homes and subdivisions and large-scale systems, the analytical model could be used for subdivisions and large-scale systems, and the solute-transport model could be used for large-scale systems. (Author's abstract)
W87-08207

ACID RAIN AND TRANSPORTED AIR POLLUTANTS: IMPLICATIONS FOR PUBLIC POLICY.
Office of Technology Assessment, Washington, DC.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-016528. Price codes: A03 in paper copy, A01 in microfiche. Summary, (1984). 34 p, 9 fig.

Descriptors: *Acid rain, *Public policies, *Path of pollutants, *Legislation, *Air pollution, Environmental effects.

The current controversy over acid rain - the most publicized example of transported pollutants - focuses on the risks to the environment and the population, versus the costs of cleanup. Since 1980, the committees responsible for reauthorizing the Clean Air Act -- the House Committee on Energy and Commerce and the Senate Committee on Environment and Public Works -- have called on the Office of Technology and Assessment (OTA) many times for information about the movements, fate, and effects of airborne pollutants, the risks that these transported air pollutants pose to sensitive resources, and the likely costs of various proposals to control them. Over the course of the debate, OTA has provided extensive testimony and staff memoranda to the requesting committees, and published a two-volumne technical analysis, 'The Regional Implications of Tranported Air Pollutants', in July 1982. This report synthesizes OTA's technical analysis of acid rain and other transported pollutants, and presents policy alternatives for congressional consideration. (Lantz-PTT)
W87-08208

SODIUM THIOSULFATE'S FATE IN ACTIVATED SLUDGE,
Texas Univ. at Austin. Center for Research in Water Resources.
E. F. Millano, and E. F. Gloyna.
Technical Report No. CRWR 185, December 1981. 90 p, 24 fig, 5 tab, 38 ref.

Descriptors: *Sodium thiosulfate, *Activated sludge, *Fate of pollutants, *Wastewater treatment, Sludge, Neutralization, Hydrogen ion concentration, Sulfur, Organic carbon.

The fate of high concentrations (up to 1860 mg/L) of sodium thiosulfate, Na2S2O3.5H2O, in activated sludge units treating a synthetic wastewater made up of dextrose, nutrients and 77.5 mg/L sodium thiosulfate, was studied using both batch and continuous activated sludge reactors. The batch units were utilized on a fill and draw basis. Control of pH through neturalization and increase of nutrients were evaluated as counter measures for the production of sulfuric acid, which is an end product of the biological oxidation of sodium thiosulfate. The addition of a step input of a high sodium thiosulfate concentration, up to 1860 mg/L, to activated sludge units treating a synthetic feed resulted in a reduction in pH, a decrase in the filtered total organic carbon (FTOC) removal, and a decrease in the conversion of thiosulfate to soluble sulfate. Elemental sulfur was produced in the aeration units at pH values below 6, probably due to the chemical decomposition of sodium thiosulfate at low pH values. By controlling the pH through neutralization with alkalinity, and by increasing the concentration of nitrogen and phosphorus in the feed by at least four times the levels required for typical bacterial metabolism, it was possible to treat a sodium thiosulfate concentration of 1860 mg/L, with a FTOC concentration of 160 mg/L. A 95% conversion of thiosulfate to soluble sulfate was obtained, with a FTOC removal of 87%. This FTOC removal decreased in comparison to the FTOC removal (92%) observed prior to the addition of the step input of high sodium thiosulfate concentration. (Author's abstract)
W87-08223

TRANSPORT AND FATE OF POLYCHLORINATED BIPHENYLS IN A NATURAL SYSTEM,
Texas Univ. at Austin. Center for Research in Water Resources.
K. M. Kuhr, and N. E. Armstrong.
Technical Report No. CRWR 190, May 1982. 145 p, 33 fig, 8 tab, 50 ref, 2 append.

Descriptors: *Path of pollutants, *Fate of pollutants, *Polychlorinated biphenyls, *Ecosystems, *Model studies, Suspended solids, Aroclor, Fish, Sediment concentration, Flow rates.

The fate and transport of polychlorinated biphenyls (PCBs) in a natural system were studied, and a model was applied in an effort to determine likely inputs and to forecast future PCB contamination levels in the system. Concentrations of PCBs found in the water, sediment, and biota samples were within ranges commonly reported in the literature. Large errors in quantification and contamination in the blanks, however, made those results suspect. The model was made up of five first-order differential equations. Two described the particulate concentrations in the water and the bed, and the other three described the PCB concentrations in the water, the sediment, and the fish. The model was most sensitive to changes in the values used for the partition coefficient, the settling velocity, and the vapor loss of PCBs from the water phase to the atmosphere. Also included in the model were equations defining various parameters as functions of the suspended solids concentration (settling velocity) and of the inflow rate (concentration of inflowing suspended solids and resuspension velocity). Various PCB inputs were fed into the model and the responses were related to field measurements. Pulse and decreasing mass inputs of 4.9 E 5 gm PCB in May, 1975 produced sediment and water PCB concentrations similar to those detected in the field in October, 1980; however, the model output fish PCB concentration was five times as high as the concentration detected in the fish sample. Modeled inputs of 27 gm of Aroclor 1260 over 64 days and 236 gm of Aroclor 1254 over 92 days produced average output fish PCB concentrations similar to those detected in fish samples -- 81 micrograms/kg and 106 micrograms/kg, respectively. A sediment PCB concentration vs. depth profile was constructed for lake sediments from field observations, and a PCB input was subsequently modeled that produced a similar profile. The effects of diffusion and leaching were discussed as they pertained to the sediment PCB concentration vs. depth profile. (Author's abstract)
W87-08224

PRACTICAL MANUAL FOR DETERMINING SETTLING RATES OF OCEAN DISPOSED SEWAGE SLUDGE,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5E.
W87-08227

ANNUAL REPORT: 1983. ENVIRONMENTAL MEASUREMENTS LABORATORY, USDOE.
Department of Energy, New York. Environmental Measurements Lab.
For primary bibliographic entry see Field 9C.
W87-08241

BEDFORM-GENERATED CONVECTIVE TRANSPORT IN BOTTOM SEDIMENT,
Louisiana State Univ., Baton Rouge. Hazardous Waste Research Center.
L. J. Thibodeaux, and J. D. Boyle.
Nature NATUAS, Vol. 325, No. 6102, p 341-343, January 1987. 4 fig, 9 ref.

Descriptors: *Convective transport, *Bottom water, *Bottom sediments, *Sand waves, *Path of pollutants, *Model studies, Pollutants, Sediment transport, Sediment load, Sediment sorting.

The flow of water over mobile, non-cohesive bed material such as silt, sand, and gravel usually produces a series of sediment sandwaves. These waveforms have been observed on the bottom of all aquatic environments where active water flows over unconsolidated bed material. Convective flow within bed sediment is an important mechanism enhancing the mobility of chemicals, both natural and anthropogenic, and thermal energy in this region of aquatic environments. Experimental observations indicated that significant in-bed convection currents can be generated by water flowing over small obstructions on the surface of a porous bed. Significant porewater flow is induced by imbalances in pressure over distance, generated by differences in temperature, density and hydrostatic head. Laboratory simulation and a vignette model have demonstrated that flow over bedforms induces additional pressure imbalances which generate significant and complex convection currents within porous bed sediment. A model is proposed for estimating Peclet numbers for this effect. The results have particular application to chemical transport in the upper sediment layer that is often the recipient of high levels of chemical contamination. Although this analysis reflects river conditions, the results may have wider applications and include submarine currents moving over dune-like mega ripples on the ocean floor. (Author's abstract)
W87-08254

CHLORINATION BYPRODUCTS OF ARABIAN GULF SEAWATER,
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
For primary bibliographic entry see Field 5F.
W87-08261

SIZE AND MERCURY CONCENTRATION RELATIONSHIP AS CONTAMINATION INDEX,
Cordoba Univ. (Spain). Dept. de Higiene.
F. Rincon, G. Zurera, and R. Pozo-Lora.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 515-522, March 1987. 1 fig, 2 tab, 28 ref.

Descriptors: *Mercury, *Path of pollutants, *Bioaccumulation, *Analytical methods, *Crayfish, *Heavy metals, *Mullet, Aquatic environment, Aquatic habitats, Tissue analysis, Marshes, Rivers, Crustaceans, Fish.

This study examined the level of mercury contamination in populations of red crayfish (Procambarus clarkii) and gray mullet (Liza ramada) in the marshes of the Guadalquivir River. The validity of using the relationship between size (as weight or length) and mercury contamination in muscle as evidence of mercury contamination in the aquatic environment is discussed. There were no sexual differences in mercury contamination in these two species. Crayfish averaged 100 ng/g and mullet averaged 63 ng/g. (McFarlane-PTT)
W87-08265

ORGANOCHLORINE PESTICIDE RESIDUES IN CHILEAN FISH AND SHELLFISH SPECIES,
Universidad Tecnica Federico Santa Maria, Valparaiso (Chile). Dept. of Chemistry.
A. Ober, M. Valdivia, and I. Santa Maria.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 528-533, March 1987. 1 fig, 2 tab, 10 ref.

Descriptors: *Organochlorine pesticides, *Chile, *Path of pollutants, *Pesticides, *Organic pesticides, *Fish, *Shellfish, *Tissue analysis, Lindane, Aldrin, Dieldrin, DDT, DDE, Heptachlor, Public health, Contamination.

While DDT and its derivatives were banned in Chile in 1983, other organochloride pesticides are still widely used. Seven marine fishes and 4 marine shellfishes from Valparaiso and Concepcion bays were analyzed. All marine species contained detectable amounts of organochlorine pesticides but all values were below tolerance levels prescribed for Chilean foods. Lindane and aldrin were present in almost all species while other pesticides were unequally distributed. Lindane contamination ranged from 0 to 740 ppb in fishes (bottom dwellers had the lowest values) and 0 to 113 ppb in shellfishes. Aldrin was 0 to 300 ppb in fishes and 4 to 33 ppb in shellfishes. (See also W87-08268) (McFarlane-PTT)
W87-08267

HEAVY METALS IN MOLLUSCAN, CRUSTACEAN, AND OTHER COMMERCIALLY IMPORTANT CHILEAN COASTAL WATER SPECIES,
Universidad Tecnica Federico Santa Maria, Valparaiso (Chile). Dept. of Chemistry.
A. G. Ober, M. Gonzalez, and I. Santa Maria.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 534-539, March 1987. 1 fig, 2 tab, 11 ref. Direccion General de Investigacion y Postgrado Project 86.24.01.

Descriptors: *Heavy metals, *Contamination, *Path of pollutants, *Mollusks, *Crustaceans, *Tissue analysis, *Chile, Coastal waters, Copper, Zinc, Cadmium, Lead, Mercury, Nickel, Antimony, Selenium, Iron, Chromium, Public Health.

This study determined the concentrations of 10 heavy metals in 12 marine species of commercial importance collected from Valparaiso, Concepcion and Puerto Montt. Mercury was not detected in any species, and selenium was present only at very low levels (<0.01 ppm dry wt). Zinc ranged from 274-464 ppm, cadmium 0-8.2 ppm, lead 0-32.7 ppm, copper 6.8-32.7 ppmm, chrom 0-2.2 ppm, nickel 0-4.2 ppm. Cd, Pb, Cu and Ni were highest in mollusks. Zn and Fe were highest in crustaceans. Some species had Zn, Cd, Cu and Pb above permitted maximum levels and could represent a health threat. (See also W87-08267) (McFarlane-PTT)
W87-08268

COPPER, CADMIUM, AND NICKEL ACCUMULATION IN CRAYFISH POPULATIONS NEAR COPPER-NICKEL SMELTERS AT SUDBURY, ONTARIO, CANADA,
Laurentian Univ., Sudbury (Ontario). Dept. of Biology.
G. Bagatto, and M. A. Alikhan.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 540-545, March 1987. 3 tab, 19 ref.

Descriptors: *Path of pollutants, *Bioaccumulation, *Tissue analysis, *Heavy metals, *Crayfish, *Contamination, Copper, Nickel, Cadmium, Smelters, Sudbury, Ontario, Crustaceans.

The Sudbury basin, an elliptical 646 sq mile depression containing a number of freshwater reservoirs, has been subjected to extreme ecological disturbances from logging, mining and smelting activities. This study compares tissue concentration of copper, cadmium and nickel in freshwater crayfish (Orconectes virilis and Cambarus bartoni) at selected distances of the habitat from the emission source. No sexual differences in metal concentration were found. General relationship was Cd < Ni < Cu. In general, there was an inverse relationship between tissue metal content and distance of the habitat from the smelter. The highest concentration of each metal was observed in the hepatopancreatic tissue, and the lowest was found in the abdominal muscles. (McFarlane-PTT)
W87-08269

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHS) IN FISH FROM THE ARABIAN GULF,
Basrah Univ. (Iraq). Marine Science Centre.
A. A. Z. DouAbdul, J. K. Abaychi, T. E. Al-Edanee, A. A. Ghani, and H. T. Al-Saad.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 546-552, March 1987. 1 fig, 1 tab, 21 ref.

Descriptors: *Polynuclear aromatic hydrocarbons, *Pollutant identification, *Path of pollutants, *Arabian Gulf, *Tissue analysis, *PAH, Fish, Carcinogens, Chromatography, Public health, Contaminants.

This study used high performance liquid chromatography to identify and measure 16 PAH priority pollutants in 14 species of commercially important fish from the northwestern Arabian Gulf. Only two PAHs, naphthalene (mean concentration 6-106 micrograms/kg wet wt edible tissue) and acenaphthene (1-69 micrograms/kg), were confirmed in the fish. It is concluded that although the Arabian Gulf marine environment is presently contaminated with numerous PAHs, including some carcinogenic homologues, apparently detoxification mechanisms effectively remove these compounds from fish tissues. (McFarlane-PTT)
W87-08270

GREATLY ACCELERATED MICROBIAL DEGRADATION OF ALDICARB IN RE-TREATED FIELD SOIL, IN FLOODED SOIL, AND IN WATER,
Department of Agriculture, Charlottetown (Prince Edward Island). Research Station.
D. C. Read.
Journal of Economic Entomology, Vol. 80, No. 1, p 156-163, February 1987. 5 fig, 20 ref.

Descriptors: *Microbial degradation, *Aldicarb, *Fate of pollutants, *Carbamate pesticides, *Soil bacteria, Microorganisms, Contamination, Toxicity, Pesticide Toxicity, Pesticides.

Total toxic residues of aldicarb persist longest in more acidic soils and more rapid breakdown to the oxiles, nitriles and other degradation metabolites occurs in near-neutral to slightly alkaline soils. Accelerated microbial degradation of carbofuran has been reported as the cause of insect control failure in repeatedly treated fields. Although aldocarb has also been used repeatedly as a soil insecticide/nematicide on crops such as potatoes, insect or nematode control failures resulting from the development of microorgansims capable of degrading this compound rapidly have not been reported. The purpose of this study was to determine if adapted aldicarb-degrading microorganisms would develop and break down this compound more rapidly after successive annual field treatments and to determine the effects of pH and soil moisture on microbial populations. Tests were also conducted to determine the potential for development of strains of microorganisms that would break down aldicarb rapidly in water. Two successive annual applications of aldicarb, as subsurface band-in-row soil treatments at 4 kg (active ingredient)/ha in the same field plots, resulted in development of strains of microorganisms that rapidly broke down aldicarb in acid mineral soils of pH above ca. 6.0. Concentration and time required for breakdown for laboratory applications of 10-750 micrograms (AI)/g (ppm) of soil were positively correlated.

Breakdown of these concentrations ranged from 1 to ca. 14 days. Concentrations higher than ca. 800 ppm appeared to retard bacterial action and inhibited fungal growth in the soil. A 5,000-ppm application inhibited fungal growth for > 6 months and retarded growth during the following 6-8 months. Toxic residues from 2,000 to 5,000 ppm applications persisted for 6 mo to 1 yr or more in the moist soil but degraded faster in flooded soil. Breakdown of repeated 50 or 100-ppm applications was most rapid in alkaline and near-neutral acidic soil or water media, much slower at pH levels near 6.0, and negligible at pH levels below ca. 5.6. Rate of accelerated microbial degradation depended on pH and moisture content of the soil, amount applied per treatment, numbers of treatments, and time period between treatments of aldicarb. (Author's abstract)
W87-08271

SURVIVAL OF PATHOGENIC BACTERIA IN VARIOUS FRESHWATER SEDIMENTS,
Texas Univ. at Dallas, Richardson. Graduate Program in Environmental Sciences.
G. A. Burton, D. Gunnison, and G. R. Lanza.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 633-638, April 1987. 6 fig, 4 tab, 39 ref.

Descriptors: *Model studies, *Pathogens, *Survival, *Sediments, *Bacteria, *Limnology, Clay, Sand, Mortality.

Four human-associated bacteria, Pseudomonas aeruginosa, Salmonella newport, Escherichia coli, and Klebsiella pneumoniae, were tested for survival in five freshwater sediments. Bacterial survival in continuous-flow chambers was monitored over 14-day periods on sediments ranging from organically rich high-clay fractions to organically poor sandy fractions. Bacterial die-off ranged from 1 to 5 orders of magnitude in sediments. E. coli survived as long as or longer than S. newport. P. aeruginosa and K. pneumoniae tended to survive longer than E. coli. Survival of E. coli and S. newport was greater in sediments containing at least 25% clay. Good reproducibility allowed the development of linear models to describe die-off rates. (Author's abstract)
W87-08288

BIODEGRADATION OF CRESOL ISOMERS IN ANOXIC AQUIFERS,
Oklahoma Univ., Norman. Dept. of Botany and Microbiology.
W. J. Smolenski, and J. M. Suflita.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 710-716, April 1987. 5 fig, 3 tab, 39 ref. EPA Assistance agreements CR-812808 and CR-811146.

Descriptors: *Groundwater pollution, *Biodegradation, *Fate of pollutants, *Cresols, *Anoxic aquifers, Metabolism, Isomers, Inhibition, Molybdenum, Sulfates, Incubation, Oxidation, Catabolism.

The biodegradation of o-, m-, and p-cresol was examined in material obtained from a shallow anaerobic alluvial sand aquifer. The cresol isomers were preferentially metabolized, with p-cresol being the most easily degraded. m-Cresol was more persistent than the para-isomer, and o-cresol persisted for over 90 days. Biodegradation of cresol isomers was favored under sulfate-reducing conditions (SRC) compared with that under methanogenic conditions (MC). Slurries that were acclimated to p-cresol metabolism transformed this substrate at 18 and 330 nmol/h per g (dry weight) for MC and SRC, respectively. Inhibition of electron flow to sulfate reduction with 2.0 mM molybdate reduced p-cresol metabolism in incubations containing sulfate, p-cresol catabolism was retarded. Under SRC 3.4 mol of sulfate was consumed per mol of p-cresol metabolized. The addition of sulfate to methanogenic incubations stimulated p-cresol degradation. Simultaneous adaptation studies in combination with spectrophotometric and chromatographic analysis of metabolites indicated that p-cresol was oxidized under SRC to p-hydroxybenzoate via the corresponding alcohol and aldehyde. This series of reactions was inhibited under sulfate-limited or aerobic conditions. Therefore, the primary catabolic event for p-cresol decomposition under SRC appears to involve the hydroxylation of the aryl methyl group. (Author's abstract)
W87-08292

FATE OF VIRUSES IN ARTIFICIAL WETLANDS,
San Diego Region Water Reclamation Agency, Santee, CA.
R. M. Gersberg, S. R. Lyon, R. Brenner, and B. V. Elkins.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 731-736, April 1987. 3 fig, 3 tab, 27 ref. California Dept. of Water Resources Grant B-54835.

Descriptors: *Wastewater treatment, *Fate of pollutants, *Viruses, *Artificial wetlands, *Municipal wastewater, *Survival, Bacteriophage, Aquatic plants.

Little is known about the ability of wetlands to remove disease-causing viruses from municipal wastewater. In this study we examined the survival of several indicators of viral pollution (indigenous F-specific bacteriophages, seeded MS2 bacteriophage, and seeded human poliovirus type 1) applied in primary municipal wastewater to artificial wetland ecosystems. Only about 1% of the indigenous F-specific RNA bacteriophages survived flow through the vegetated wetland beds at a 5-cm/day hydraulic application rate during the period from June through December 1985. The total number of indigenous F-specific bacteriophages (F-specific RNA and F-specific DNA phages) was also reduced by about 99% by wetland treatment, with the mean inflow concentration over the period of an entire year reduced from 3,129 to 33 PFU/ml in the outflow of a vegetated bed and to 174 PFU/ml in the outflow of an unvegetated bed. Such superior treatment by the vegetated bed demonstrates the significant role of higher aquatic plants in the removal process. Seeded MS2 bacteriophage and seeded poliovirus were removed more efficiently than were the indigenous bacteriophages, with less than 0.2% of MS2 and 0.1% of the poliovirus surviving flow at the same hydraulic application rate. The decay rate (k) of MS2 in a stagnant wetlands (k = 0.012 to 0.028/h) was lower than that for flowing systems (k = 0.44 to 0.052/h), reflecting the enhanced capacity for filtration or adsorption of viruses by the root-substrate complex (and associated biofilm). Artificial wetlands may offer an attractive alternative to conventional land treatment systems for reducing the load of disease-causing viruses to the aquatic environment. (Author's abstract)
W87-08293

EXPLANATIONS FOR THE ACCLIMATION PERIOD PRECEDING THE MINERALIZATION OF ORGANIC CHEMICALS IN AQUATIC ENVIRONMENTS,
B. A. Wiggins, S. H. Jones, and M. Alexander.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 791-796, April 1987. 7 fig, 26 ref. PHS Training grant ES-07052.

Descriptors: *Fate of pollutants, *Acclimatization, *Mineralization, *Biodegradation, *Organic compounds, *Microbiological studies, Sewage, Lakes, Incubation, Nutrients, Degradation, Protozoa, Inhibition, Enzymes, Predation.

A study was conducted of possible reasons for acclimation of microbial communities to the mineralization of organic compounds in lake water and sewage. The acclimation period for the mineralization of 2 ng of p-nitrophenol (PNP) or 2,4-dichlorophenoxyacetic acid per ml of sewage was eliminated when the sewage was incubated for 9 or 16 days, respectively, with no added substrate. The acclimation period for the mineralization of 2 ng but not 200 ng or 2 ug of PNP per ml was eliminated when the compound was added to lake water that had been first incubated in the laboratory. Mineralization of PNP by Flavobacterium sp. was detected within 7 h at concentrations of 20 ng/ml to 2 ug/ml but only after 25 h at 2 ng/ml. PNP-utilizing organisms began to multiply logarithmically after 1 day in lake water amended with 2 ug of PNP per ml, but substrate disappearance was only detected at 8 days, at which time the numbers were approaching 100,000 cells per ml. The addition of inorganic nutrients reduced the length of the acclimation period from 6 to 3 days in sewage and from 6 days to 1 day in lake water. The prior degradation of natural organic materials in the sewage and lake water had no effect on the acclimation period for the mineralization of PNP, and naturally occurring inhibitors that might delay the mineralization were not present. The length of the acclimation phase for the mineralization of 2 ng of PNP per ml was shortened when the protozoa in sewage were suppressed by eucaryotic inhibitors, but it was unaffected or increased if the inhibitors were added to lake water. We suggest that the time for enzyme induction, mutation, diauxie, and presence of toxins are not the causes of the acclimation period for PNP mineralization in aquatic environments but rather that the acclimation period largely reflects the time for multiplication of the initially small population of active organisms. That time may be further extended by a limiting supply of inorganic nutrients in lake water or by predation by protozoa in sewage. (Author's abstract)
W87-08297

DISTRIBUTION OF IRON-OXIDIZING BACTERIA IN THE NORDIC URANIUM TAILINGS DEPOSIT, ELLIOT LAKE, ONTARIO, CANADA,
Canada Centre for Mineral and Energy Technology, Ottawa (Ontario).
M. Silver.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 846-852, April 1987. 5 fig, 31 ref.

Descriptors: *Iron bacteria, *Acid mine drainage, *Mine wastes, *Uranium, Distribution, Oxidation, Ontario, Bacteria, Iron, Sulfates, Vegetation.

Iron-oxidizing bacteria are present within the top 2 m (but not always at the surface) and near the water table-capillary fringe of the vegetated Nordic uranium deposit, Elliot Lake, Ontario, Canada. They are distributed uniformly in the top 0.5 m of unvegetated tailings. The locations of these bacteria correlate with zones of pyrite oxidation as delineated in previous studies by the formation fo soluble iron and sulfate. Heterotrophic bacteria are also present in the tailings, with greatest concentrations at the surface and near the water table-capillary fringe. Sulfate-reducing bacteria were detected in the soil and peat at the base of the tailings. The results of this study suggest that the establishment of vegetation directly upon the tailings surface does not arrest bacterial pyrite oxidation. (Author's abstract)
W87-08299

CANOPY STRUCTURE AND CLOUD WATER DEPOSITION IN SUBALPINE CONIFEROUS FORESTS,
New York Botanical Garden, Bronx, NY. Inst. of Ecosystem Studies.
For primary bibliographic entry see Field 2B.
W87-08301

CLOUD DROPLET NUCLEATION AND CLOUD SCAVENGING OF AEROSOL SULPHATE IN POLLUTED ATMOSPHERES,
Atmospheric Environment Service, Downsview (Ontario).
W. R. Leaitch, J. W. Strapp, G. A. Isaac, and J. G. Hudson.
Tellus TELLAL, Vol. 38B, No. 5, p 328-344, November 1986. 14 fig, 34 ref.

Descriptors: *Acid rain, *Air pollution effects, *Path of pollutants, *Model studies, *Cloud scavenging, *Nucleation, *Aerosol sulfates, *Air pollution, *Path of pollutants, Clouds, Cloud water, Aerosols, Sulfates, Condensation.

Aircraft investigations of the microphysical and chemical properties of mildly to moderately con-

vective clouds and stratiform clouds were conducted during the summer of 1982 and the early winter of 1984 over Algonquin Park, Ontario, Canada. Similar studies were carried out during the autumn of 1984 over upper New York state. Varying degrees of polluted conditions were observed. For the situation where the cloud liquid water content was close to the adiabatic value and the particle concentration was <750/cm, the concentration of cloud droplets was directly proportional to the number concentration of cloud-base aerosol particles. For particle concentrations above 750/cm, the cloud droplet concentration did not increase as fast as the particle numbers. An adiabatic model describing the condensational growth of cloud droplets predicted this apparent non-proportionality and indicated it to be the result of increasing competition for water vapor by increasing numbers of cloud condensation nuclei. The best quantitative agreement with the observations was obtained for the accommodation coefficient for condensation of water equal to unity and low values of the updraft speed at cloud base. Comparisons between cloud-averaged number concentrations of cloud droplets and number concentrations of cloud-base aerosol particles behaved in a very similar manner to the comparisons of near adiabatic cloud droplet concentrations with aerosol concentrations. Comparisons of the mass concentrations of cloudwater SO4(2-), with that of aerosol SO4(2-), measured at ground level, appeared to follow a similar behavior as the cloud droplet concentrations, but with a much larger uncertainty. (Author's abstract)
W87-08302

OBSERVATIONS ON ACIDITY AND IONS IN EAST GREENLAND PRECIPITATION,
Miljoestyrelsen, Roskilde (Denmark). Luftforureningslaboratoriet.
K. Keiding, and N. Z. Heidam.
Tellus TELLAL, Vol. 38B, No. 5, p 345-352, November 1986. 2 fig, 6 tab, 17 ref.

Descriptors: *Path of pollutants, *Wet deposition, *Rainfall analysis, *Acid rain, *Greenland, *Acidity, Ions, Precipitation, Arctic, Transport, Aerosols, Denmark, Faroe Islands.

Precipitation collected in East Greenland by a wet-only type of collector for two years, was analysed for all major ions. The concentrations are lower by a factor of 10 compared to a rural site in Denmark and somewhat lower than at the Faroe Islands. A pH value of 5.16 seems to be representative of arctic precipitation. Three discernible components appear to be present, a sea-spray and a crustal component and a component related to long-range transported aerosols from distant combustion sources. The total wet deposition is very small, but the risk of an effect on the sensitive arctic environment cannot be discarded without further assessment. (Author's abstract)
W87-08303

RADIONUCLIDES IN DRINKING WATER: AN OVERVIEW,
Montgomery (James M.), Inc., Pasadena, CA.
E. M. Aieta, J. E. Singley, A. R. Trussell, K. W. Thorbjarnarson, and M. J. McGuire.
Journal of the American Water Works Association JAWWA5, Vol. 79, No. 4, p 144-152, April 1987. 3 fig, 3 tab, 44 ref.

Descriptors: *Water quality, *Drinking water, *Radionuclides, *Radium, *Uranium, *Radon, Water supply, Literature searches, Public health, Regulations, Technology, Water treatment, Monitoring.

Although this article discusses radionuclides in general, its focus is on radium, uranium, and radon, which are the radionuclides of most concern to drinking water suppliers. Developed as the result of literature searches and interviews with personnel from the US Environmental Protection Agency and the California Department of Health Services, the article covers radionuclide chemistry, the occurrence of radionuclides, current and future regulations, treatment technologies, and monitoring. (Author's abstract)
W87-08307

TRANSFER OF RADON FROM DOMESTIC WATER TO INDOOR AIR,
Texas Univ. Health Science Center at Houston. School of Public Health.
H. M. Prichard.
Journal of the American Water Works Association JAWWA5, Vol. 79, No. 4, p 159-161, April 1987. 5 tab, 21 ref.

Descriptors: *Path of pollutants, *Air pollution sources, *Water quality, *Radon, *Domestic water, *Indoor air, *Reviews, Water supply, Regional analysis, Distribution.

Theoretical and experimental literature dealing with the release of radon from water to air is reviewed and synthesized. Primary emphasis is placed on releases from domestic water supplies to indoor air within the context of a general indoor radon problem. The widely used assumption of 1 pCi/L increment in indoor air per 10000 pCi/L in the water supply is valid, but regional and individual variations are important. (Author's abstract)
W87-08309

COMPARATIVE STUDY OF THE PATTERNS OF BIOACCUMULATION OF ESSENTIAL (CU, ZN) AND NON-ESSENTIAL (CD, PB) TRACE METALS IN VARIOUS ESTUARINE AND COASTAL ORGANISMS,
Nantes Univ. (France). Lab. de Toxicologie.
J. C. Amiard, C. Amiard-Triquet, B. Berthet, and C. Metayer.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 106, No. 1, p 73-89, March 1987. 8 fig, 1 tab, 36 ref.

Descriptors: *Path of pollutants, *Bioaccumulation, *Comparison studies, *Trace metals, *Estuaries, *Coastal waters, Population exposure, Copper, Zinc, Cadmium, Lead, Heavy metals, Mathematical equations, Fish, Worms, Mollusks, Crustaceans.

The patterns of accumulation of essential and non-essential trace metals have been studied comparatively in worms, mollusks, crustaceans, and fish exposed to short-term experimental contaminations and low chronic contaminations in a polluted environment. In short-term contaminations, the concentrations X of the non-essential metals cadmium and lead in the organisms depend mainly on their environmental level Y according to the power function $Y = a X$ to the b power. For copper, an essential metal, this equation is also suitable to describe the bioaccumulation in some species (Nereis diversicolor O.F. Muller, Scobicularia plana (da Costa), Gammarus zaddachi Sexton) for a large range of experimental overloads. As for the mussel Mytilus edulis L., this equation is accurate for medium or high overloads only. All the species are able to control the level of the essential zinc in their tissues but for both copper and zinc the best regulators are the more highly evolved forms including decapod crustaceans and fish. The in situ chronic contaminations support the same conclusions. In one fish and one decapod crustacean species it has been shown that the regulation mechanisms may be functional since early life stages. When the duration of exposure to essential metals increases, the regulation mechanism is, however, disturbed by more and more low additional concentrations in sea water. (Author's abstract)
W87-08320

EVALUATION OF UNCERTAINTY ASSOCIATED WITH ALUMINUM EQUILIBRIUM CALCULATIONS,
Syracuse Univ., NY. Dept. of Civil Engineering.
W. D. Schecher, and C. T. Driscoll.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 525-534, April 1987. 4 fig, 4 tab, 42 ref.

Descriptors: *Water chemistry, *Water pollution sources, *Acid rain, *Aluminum, *Computer models, *Model studies, Monte Carlo method, Speciation, Equilibrium, Thermodynamics, Prediction.

There is considerable concern over the impact of elevated concentrations of Al in drainage waters acidified by atmospheric deposition. Computer models developed to evaluate the acidification of surface waters generally rely on thermodynamic calculations to predict the concentration and speciation of Al. We present a simple chemical equilibrium model that can be used to evaluate the chemistry of acidic waters which favorably agrees with results obtained from more comprehensive models. Additionally, we evaluate the effect of error in thermodynamic data on calculations of Al chemistry by Monte Carlo methods. Variations in model output due to uncertainty in the determination of equilibrium constants were small. However, there is considerable variation within the literature of thermodynamic data for a given reaction. This 'literature error' results in as much as 100% variation in the concentration of Al complexes. (Author's abstract)
W87-08328

EVALUATION OF A GROUNDWATER CORRECTIVE ACTION AT THE CHEM-DYNE HAZARDOUS WASTE SITE USING A TELESCOPIC MESH REFINEMENT MODELING APPROACH,
GeoTrans, Inc., Herndon, VA.
For primary bibliographic entry see Field 5G.
W87-08337

SIMULATION OF CONTAMINANT TRANSPORT IN THREE DIMENSIONS: 1. THE ALTERNATING DIRECTION GALERKIN TECHNIQUE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 7C.
W87-08346

SIMULATION OF CONTAMINANT TRANSPORT IN THREE DIMENSIONS: 2. DIMENSIONALITY EFFECTS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 7C.
W87-08347

APPLIED ENVIRONMENTAL GEOCHEMISTRY,
For primary bibliographic entry see Field 2K.
W87-08353

PRINCIPLES OF ENVIRONMENTAL GEOCHEMISTRY,
Institute of Geological Sciences, London (England). Metalliferous Minerals and Applied Geochemistry Unit.
For primary bibliographic entry see Field 2K.
W87-08354

GEOCHEMISTRY AND WATER QUALITY,
Kansas Univ., Lawrence. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W87-08357

ASSESSMENT OF METAL POLLUTION IN RIVERS AND ESTUARIES,
Technische Univ. Hamburg-Harburg (Germany, F.R.).
U. Forstner.
In: Applied Environmental Geochemistry, Academic Press, London. 1983. p 395-423, 4 fig, 8 tab, 166 ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Metals, *Sediments, *Dredging, Indicators, Bioindicators, Accumulation, Bioaccumulation, Monitoring, Estuaries, Rivers, Bioassay, Suspended sediments, Adsorption, Sample preparation, Pore water, Particle size, Baseline studies, Statistical analysis, Correlation analysis, Cluster analysis, Principal component analysis, Pollutant identification.

Methods of investigating metal loads in the aquatic system differ according to the purpose of the study. Pollution can be assessed in waters and

sediments. Water analysis is not too reliable; fluctuations, complexing, and natural background levels are often difficult to interpret. Indicator organisms, such as Mytilus edulis, have been used in many monitoring studies for trace metals. Analysis of suspended sediments and other matter, which adsorb many pollutants, are valuable sources of information. For sediment studies, sample preparation is discussed for suspended sediment, bed sediment, pore water, and sediment digestion. Methods to correct for grain size effects include: separation of fractions, extrapolation for regression curves, correction for inert minerals, and comparison with conservative elements. Background (precivilization) levels of trace metals must be established by analyzing average shale composition, fossil aquatic sediments, recent deposits in unpolluted areas, or dated sedimentary cores. The index of geoaccumulation consists of six grades, of which the highest (6) indicates 100-fold enrichment over background values. Statistical analysis methods for use in trace metal study include correlation coefficients, cluster analysis, and principal component analysis. The transfer of metals within the sediment-water-biota system can be determined by sediment-water interrelations, elutriate tests, and chemical extraction sequences. Bioassays on dredging activities can be directed toward the liquid phase (algae, zooplankton), solid phase (benthic organisms), or bioaccumulation. (See also W87-08353) (Cassar-PTT)
W87-08358

HEAVY METAL CONTAMINATION FROM BASE METAL MINING AND SMELTING: IMPLICATIONS FOR MAN AND HIS ENVIRONMENT,
University Coll. of Wales, Aberystwyth. Dept. of Geography.
B. E. Davies.
IN: Applied Environmental Geochemistry, Academic Press, London. 1983. p425-462, 8 fig, 18 tab, 133 ref.

Descriptors: *Water pollution sources, *Fate of pollutants, *Mineral industry, *Metals, Heavy metals, Metallurgy, Sulfides, Zinc, Lead, Cadmium, Flotation, Rivers, Mine wastes, Spoil banks, Air pollution, Vegetation, Water pollution effects, Bioaccumulation, Accumulation, Soil horizons, Land reclamation.

Metals have been mined and smelted since man's early history. Every time metals and their ores are heated, pulverized, or dissolved, they may escape to the environment. The heavy metal levels vary among different geological formations. They are especially high in black shales and sulfide ores. The mining and refining processes offer many opportunities for pollution of water. The old process of gravity separation in water, usually discharged ore and dissolved metals into nearby streams. Froth flotation has replaced gravity separation in many places. However, froth chemicals (organic acid, soaps, xanthates, dithiophosphates, copper sulfate) are themselves pollutants. The metals and their compounds may be released to the environment in several forms: solutions, colloids, suspended particles, gases, aerosols, dusts, and tailings. They reach sinks such as sediments, soils or biota by fluvial dispersal, atmospheric dispersal, and gravitational dispersal. Aquatic ecosystems are usually the first to be damaged from mining pollution. In soils, metals accumulate at different horizons. Cu, Hg, and Pb are enriched in the surface horizons; the fates of some other metals are more complex. Heavy metals have low leachability and also tend to accumulate in organic-rich layers. Metal bioconcentration in earthworms is a significant route for the toxic materials to mix throughout the soil and reach other wildlife. Reclamation of tailings is difficult because of plant toxicity and a substrate which is either too dry or too waterlogged. Many cases of polluted water supplies have been attributed to mining activities. (See also W87-08359) (Cassar-PTT)
W87-08359

ANNUAL EFFLUENT AND ENVIRONMENTAL MONITORING REPORT FOR CALENDAR YEAR 1981.
Bettis Atomic Power Lab., West Mifflin, PA.
Available from the National Technical Information Service, Springfield, VA 22161, as DE82-013958. Price codes A03 in paper copy and A01 in microfiche. WAPD-RC/E(ESE)--576, April 1982. 43 p, 1 fig, 5 tab, 17 ref. 1 app. DOE Contract No. DE-AC11-76PN00014.

Descriptors: *Water quality control, *Water pollution control, *Fate of pollutants, *Radioactive wastes, *Industrial wastes, *Monitoring, Bettis Atomic Power Laboratory, Effluents, Water reuse.

The results of the effluent and environmental monitoring program for 1981 at the Bettis Laboratory are presented. The results obtained from the effluent monitoring program show that the existing procedures for controlling liquid and airborne effluents ensure that all such releases during 1981 were made in accordance with applicable Federal regulations. Radioactive waste liquids were treated by filtration and ion exchange before release to streams. However, in December 1981 a startup of a water reuse system ended release of effluents to streams. The estimated radioactivity emitted in liquid effluents during 1981 was <0.003 curie. No radioactive wastes were released to the sanitary sewers during the year. Evaluation of the effluent and environmental data indicates that the operation of the Laboratory continued to have no adverse effect on the quality of the environment. Furthermore, a conservative assessment of the radiation exposure from the small radioactivity releases from the Bettis Laboratory demonstrated that the dose estimates were too low to measure and were well below the most restrictive dose limits prescribed by the Environmental Protection Agency and the Department of Energy. (Cassar-PTT)
W87-08361

LEACHING EVALUATION OF AGRICULTURAL CHEMICALS (LEACH) HANDBOOK,
Anderson-Nichols and Co., Inc., Palo Alto, CA.
J. D. Dean, P. P. Jowise, and A. S. Donigian.
EPA-600/3-84-3116, June 1984. Environmental Protection Agency, Athens, GA. 407 p, 27 fig, 8 tab, 30 ref. 2 app.

Descriptors: *Fate of pollutants, *Pesticides, *Agricultural chemicals, *Leaching, *Root zone, Insecticides, Herbicides, Corn, Soybeans, Wheat, Cotton, Cropland, LEACH model, Model studies, Mathematical models, Degradation, Aldicarb, Diuron.

A methodology has been developed to assess potential pesticide leaching from the crop root zones in major (corn, soybean, wheat and cotton) crop growing areas of the United States. Use of the Leaching Evaluation of Agricultural Chemicals (LEACH) methodology provides an indication of the presence or absence of leaching past the rooting depth and, if such leaching is indicated, its severity. LEACH was developed through the use of long term simulation (25 years) of annual pesticide leaching time series using the Pesticide Root Zone Model. The user must evaluate key parameters for a pesticide-site-crop-management scenario to locate pesticide leaching cumulative frequency distributions. Each scenario has a unique distribution associated with it. The distribution functions indicate the change that the annual quantity of pesticide leached past the crop rooting depth will exceed a given value. The distributions can be used as an integral part of a framework for decisions concerning the use of the pesticide. (Cassar-PTT)
W87-08362

USER'S MANUAL FOR THE INSTREAM SEDIMENT-CONTAMINANT TRANSPORT MODEL SERATRA,
Battelle Pacific Northwest Labs., Richland, WA.
Y. Onishi, and S. E. Wise.
EPA 600/3/82-055, May 1982. Environmental Protection Agency, Athens, GA. 187 p, 1 fig, 6 tab, 7 ref, 1 app.

Descriptors: *Fate of pollutants, *Sediments transport, *Pesticides, *Mathematical models, *Path of pollutants, *Computer programs, *Particulate matter, SERATRA model, Rivers, Risks, Instream transport models.

This is a user's manual for SERATRA, the instream sediment-contaminant transport model. SERATRA is an unsteady, two dimensional code that uses the finite element computation method with the Galerkin weighted residual technique. The model has general convection-diffusion equations with decay and sink/source terms with appropriate boundary conditions. The model, available in FLECS and FORTRAN IV, consists of one main program and 41 subroutines. The system combines a sediment transport submodel, a dissolved contaminant transport submodel, and a submodel for transport of contaminants adsorbed by sediment. SERATRA is an integral part of the Chemical Migration and Risk Assessment Methodology, which predicts overland and instream pesticide migration and fate to assess the potential short-and long-term impacts on aquatic biota in receiving streams. (Cassar-PTT)
W87-08364

ANALYZING SALINITY RESPONSE IN SAN FRANCISCO BAY,
Corps of Engineers, San Francisco, CA. San Francisco District.
J. F. Sustar.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 218-228, 7 fig.

Descriptors: *Water resources development, *Water management, Resources management, Aquatic environment, Ecosystems, Estuaries, Estuarine environment, Bays, Mathematical analysis, Water quality.

A data collection system is described which was established to test a model on salinity encroachment into the San Francisco Bay. To use the model to predict changes, two years of field data collection were undertaken. Six stations were established to measure salinity, temperature, turbidity, current speed and direction and tidal elevation at three depths in the water column at 30 minute intervals. Preliminary analyses of the data are discussed and analytical procedures, including multivariate and regression analyses, are discussed. (See also W87-08365) (Halterman-PTT)
W87-08388

PRINCIPLES OF WATER QUALITY,
Miami Univ., Coral Gables, FL. Dept. of Civil and Architectural Engineering.
T. D. Waite.
Academic Press, Inc., Orlando, FL. 1984. Water Resources and Water Quality Management: An International Series of Books. 289 p.

Descriptors: *Fate of pollutants, *Water pollution sources, *Water quality, Organic compounds, Dissolved oxygen, Oxygen, Heavy metals, Metals, Toxicity, Pesticides, Insecticides, Herbicides, Polychlorinated biphenyls, Detergents, Surfactants, Humic acids, Hydrocarbons, Oil, Nutrients, Productivity, Eutrophication, Phosphorus, Nitrogen, Sulfur, Microorganisms, Thermal pollution, Air pollution, Model studies, Standards, Water quality standards, Water management, Water pollution effects.

This book introduces engineering and science students to the fundamental environmental processes that regulate the movement of materials in natural systems, with emphasis on contaminants which have become water quality problems--toxic metals, inorganic nutrients, and organics. Engineering approaches for water quality improvement other than sewage treatment are presented. Topics discussed include natural environmental processes (energy transfer, ecological succession, organic carbon dynamics, and dissolved oxygen); toxic metals behavior; refractory organic compounds (pesticides, petroleum hydrocarbons, detergents, polychlorinated biphenyls, and humic substances); nutrients, productivity, and eutrophication; microorganisms; thermal pollution; the effect of air pollution; modeling; and water quality standards and management. (See also W87-08392 and W87-0393) (Cassar-PTT)
W87-08391

POTENTIAL IMPACT OF AIR CONTAMINANTS ON WATER QUALITY,
Northwestern Univ., Evanston, IL. Dept. of Civil Engineering.
J. E. Quon.
IN: Principles of Water Quality, by T. D. Waite. Academic Press, Inc., Orlando, FL. 1984. p 178-211, 11 tab, 69 ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Air pollution, *Water quality, Aerosols, Dusts, Snowmelt, Phosphorus, Nitrogen, Ammonia, Precipitation, Nitrates, Organic matter, Urban areas, Sulfates, Acid rain, Deposition, Particulate matter.

A method has been developed for estimating the fluxes onto land of substances in the air that have a potential impact on a selected set of water quality indices. The effect of air contaminants on water quality depends on the fraction of the air-to-land flux tranferred to water, the rate at which this fraction reaches a body of water, and the capacity of the body of water to assimilate the substance. The soil retains and transforms much of the material deposited on it and also removes material from rainwater flowing over it. The total flux of contaminants from air to land is an order of magnitude greater in urban areas than on a global basis. About 20-50% of inorganic nitrogen deposited will reach surface water systems. Phosphorus from atmospheric sources contributes to streams about 25% of the amount contributed by domestic sewage; inorganic nitrogen, the same or a greater amount; and suspended solids, many times greater. Organic materials from the atmosphere, usually derived from combustion, are not easily biodegradable. Temporal and spatial variations in air and water quality are important. For example, snowmelt rapidly transfers deposited substances into water bodies. Sample calculations are given for urban areas with clean and polluted air. (See also W87-08391) (Cassar-PTT)
W87-08392

WATER QUALITY MODELING,
Miami Univ., Coral Gables, FL. Dept. of Civil and Architectural Engineering.
N. J. Freeman.
IN: Principles of Water Quality, by T. D. Waite. Academic Press, Inc., Orlando, FL. 1984. p 212-233, 8 fig, 1 ref.

Descriptors: *Fate of pollutants, *Water quality, *Model studies, Phosphorus, Diffusion, Advection, Mathematical models, Mass transfer, Law of continuity, Fick's law, Dissolved oxygen, Oxygen, Boundary conditions, Streams, Wastewater disposal.

Mathematical modeling is useful in determining the effects of human activity on water quality. Chemicals or biological material within fluids are moved from one point to another by advection or diffusion. Mass transport rates, the law of continuity, and Fick's law of diffusion are discussed. Some common water quality models are developed to show how material inputs and transports are handled: dissolved oxygen system and inputs to and selection of boundaries for a stream reach. Two case studies apply water quality modeling to practical applications: phosphorus and longitudinal dispersion. (See also W87-08391) (Cassar-PTT)
W87-08393

PARTITION COEFFICIENT AND WATER SOLUBILITY IN ENVIRONMENTAL CHEMISTRY,
Oregon State Univ., Corvallis. Environmental Health Sciences Center.
C. T. Chiou.
IN: Hazardous Assessment of Chemicals: Current Developments, Vol. 1, Academic Press, New York. 1981. p 117-151, 5 fig, 5 tab, 114 ref. Contract No. ES-02400.

Descriptors: *Fate of pollutants, *Organic compounds, *Solubility, *Soil organic matter, *Bioaccumulation, Chemical reactions, Separation techniques, Solubility coefficient, Theoretical analysis, Chromatography, Biological magnification, Sorption, Absorption, Mathematical studies, Fish.

The use of partition coefficients to estimate contaminant distribution in the environment has become widespread during the last decade. Solvent-water partition equilibria are analyzed in terms of the solubility behavior of a diverse group of organic liquids and solids, thus providing a criterion for the validity of estimating octanol-water partition coefficients from substituent constants. A theoretical interpretation of the relationship between octanol-water partition coefficients and aqueous solubility and a theoretical interpretation of the relationship between partition coefficients from two solvent-water systems are also given. The applicability of the high pressure liquid chromatography technique for determination of the octanol-water partition coefficient is considered in reference to the column composition and stability. The use of the octanol-water partition coefficient and aqueous solubility in predicting the bioconcentration potential and the soil-water distribution of organic compounds is presented. The bioconcentration factor is defined as the ratio of the concentration in an organism or the tissue of an organism to that in water. Because of high variabilities of the soil composition, the uptake of organic compounds by soil depends critically on the type and the content of soil components, as well as the media to which the soil is exposed. (See also W87-08394) (Geiger-PTT)
W87-08398

MODELING OF TOXIC SPILLS INTO WATERWAYS,
Florida Univ., Gainesville. Dept. of Civil Engineering.
B. A. Benedict.
IN: Hazard Assessment of Chemicals: Current Developments, Vol. 1, Academic Press, New York. 1981. p 251-301, 3 fig, 3 tab, 108 ref.

Descriptors: *Model studies, *Path of pollutants, *Fate of pollutants, *Hazardous materials, *Mathematical models, Models, Toxins, Numerical analysis, Mathematical equations, Mixing, Rivers, Estuaries, Waterways.

Techniques for modeling possible spills of toxic materials are reviewed along with basic convective-diffusion equation development by the use of a natural coordinate system. The vertical coefficient uses the accepted value of 0.067 hu (depth times shear velocity). The transverse coefficient has a standard value of 0.15 hu for straight, uniform reaches. Bends increase this to as high as 2 hu. Both analytical and numerical solutions are reviewed, although analytical solutions probably offer the best tools for the general user. Solutions by both the method of images and integral transform methods are discussed. Each provides equivalent results. In estuaries, a model should include tidal velocity variation, rather than utilizing only the longitudinal dispersion coefficient. In rivers, it is preferable to use a two-dimensional model after vertical mixing has been achieved. A three-dimensional model is recommended for the three-dimensional phase prior to full vertical mixing. The models discussed provide very useful tools for planning, assessment, and spill response. (See also W87-08394) (Geiger-PTT)
W87-08399

ENVIRONMENTAL AND LABORATORY RATES OF VOLATILIZATION OF TOXIC CHEMICALS FROM WATER,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. Mackay.
IN: Hazard Assessment of Chemicals: Current Developments, Vol. 1, Academic Press, New York. 1981. p 303-322, 3 fig, 2 tab, 42 ref.

Descriptors: *Path of pollutants, *Air-water interfaces, *Toxins, *Volatility, *Mathematical models, Fate of pollutants, Hazardous materials, Volatile solids, Solubility, Models, Model studies.

Mechanisms of air-water exchange of toxic chemicals include volatilization, diffusion, nondiffusive processes, and spraying (in the form of dissolved solids in water droplets). A sound theoretically based framework is presented for calculating the volatilization rates of solutes from lakes and other water bodies. The important parameters are those describing the phase equilibrium which can be regarded as either the Henry's law constant or the fugacity capacities, and those describing the kinetics of the system which take the form of resistances or mass transfer coefficients and diffusivities. The mathematical procedure by which these parameters can be combined to yield steady-state volatilization rate estimates has been derived. Some uncertainty exists about the precise values of mass transfer coefficients and diffusivities, and particularly about the resistance of surface organic film, but the experimental strategies necessary to elucidate the values are fairly clear. Laboratory systems can be used to study the likely environmental behavior of volatilizing solutes, but care must be exercised to ensure that the controlling process is properly identified. The safest approach is to use the general equation, at least initially, until the dominance of the various terms is determined. (See also W87-08394) (Geiger-PTT)
W87-08400

DIRECT AND INDIRECT EFFECTS OF ACIDIC DEPOSITION ON VEGETATION, ACID PRECIPITATION SERIES, VOLUME 5.
For primary bibliographic entry see Field 5C.
W87-08401

WATER QUALITY ASSESSMENT: A SCREENING PROCEDURE FOR TOXIC AND CONVENTIONAL POLLUTANTS; PART 2,
Tetra Tech, Inc., Lafayette, CA.
W. B. Mills, J. D. Dean, D. B. Porcella, S. A. Gherini, and R. J. M. Hudson.
Available for the National Technical Information Service, Springfield, VA 22161, as PB83-153130. Price codes: A99 in paper copy; and A01 in microfiche. EPA/600/6-82-004b, September 1982. 656 p, 41 fig, 28 tab, 109 ref, 8 append. Contract No. 68-03-2673.

Descriptors: *Water analysis, *Chemical analysis, Water law, Legal aspects, Water pollution control, Environmental protection, Water quality, Water quality control, Water quality management, Pollutants.

New technical developments in the field of water quality assessment and a rendering of water quality priorities prompted a revision of Water Quality Assessment: A Screening Methodology for Nondesignated 208 Areas (EPA-600/9-77-023). The utility of the revised manual is enhanced by the inclusion of information on the accumulation, transport, and fate of toxic chemicals in the environment. The new subtitle--A Screening Procedure for Toxic and Conventional Pollutants--reflects the added data. Applying the manual's simple techniques, the user is now capable of assessing the load and fate of conventional pollutants (temperature, biochemical oxygen demand-dissolved oxygen, nutrients, and sediments) and toxic pollutants (from the U.S. EPA list of priority pollutants) in streams, impoundments, and estuaries. The techniques are readily programmed on hand-held calculators. Most of the data required for using these procedures are contained in the manual. Part 2 of the report contains chapters on the assessment of impoundments and estuaries. (Author's abstract)
W87-08409

PLUTONIUM, CESIUM, URANIUM, AND THORIUM SERIES RADIONUCLIDES IN THE HUDSON RIVER ESTUARY AND OTHER ENVIRONMENTS: ANNUAL TECHNICAL PROGRESS REPORT,
Lamont-Doherty Geological Observatory, Palisades, NY.
H. J. Simpson, R. M. Trier, and R. F. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161, as DE83-001414. Price codes: A04 in paper copy; and A01 in microfiche. C00-2529-21, DOE/EV/12529-21, November 1982. 44 p, 4 fig, 16 tab, 23 ref, 3 append. Grant No. DE-AC-02-76-EV-12529.

Descriptors: *Fate of pollutants, *Radioisotopes, *Sediments, Hudson River, New York, Mono

Lake, California, Saline Lakes, Estuaries, Plutonium, Cesium, Uranium, Thorium, Fallout, Radioactive wastes, Lakes.

Radionuclide activities were measured in sediment cores and suspended particle samples collected throughout the salinity range of the Hudson River estuary. Activities of Cs-137, Cs-134, Co-60, Pu-239, -240, and Pu-238, indicate reasonably rapid accumulation rates in the sediments of marginal coves and very rapid deposition in the harbor region adjacent to New York City, where Pu-239, -240 accumulations were an order of magnitude greater than the fallout delivery rate. The fallout Pu-239, -240 moving down the Hudson appears to be almost completely retained within the system by particle deposition, while 80-90% of Cs-137 derived from both reactor releases and fallout has been exported to the coastal waters by in solution. Dissolved Pu may also be moving into the estuary from adjacent coastal waters. Physical mixing in the sediment did not seem to significantly alter depth profiles of radionuclides in Hudson sediments where particles accumulate at >1% cm/yr. In the saline (with a high carbonate concentration) Mono Lake, California, fallout Pu-239, -240 activity in the water column was about two orders of magnitude greater than that for fallout Pu in other continental waters. The high carbonate concentration and low molecular weight complexes are believed responsible for the enhanced Pu solubility. The absence of dissolved oxygen in the high-carbonate environment did not significantly affect the solubility of Pu and other actinides. The activities of U-238, U-234, Th-232, Th-230, and Th-228 in saline water were also orders of magnitude greater than in other natural waters. (Cassar-PTT)
W87-08411

MICROBIAL ECOLOGY OF RUM JUNGLE II: ENVIRONMENTAL STUDY OF TWO FLOODED OPENCUTS AND SMALLER, ASSOCIATED WATER BODIES,
New South Wales Univ., Kensington (Australia).
A. E. Goodman, A. M. Khalid, and B. J. Ralph.
Available from the National Technical Information Service, Springfield, VA 22161. AAEC/E527, December 1981. Australian Atomic Energy Commission Research Establishment, Lucas Heights. 56 p, 4 fig, 9 tab, 2 maps, 15 ref, 8 append. Contract No. AAEC 74/F/40.

Descriptors: *Water pollution sources, *Fate of pollutants, *Mine drainage, *Mine wastes, *Acid mine drainage, Leachates, Sulfides, Rum Jungle Mine, Australia, Uranium mines, Spoil banks, Bacteria, Sulfur bacteria, Anaerobic conditions, Thiobacillus ferrooxidans.

Water quality and bacterial populations were studied in flooded opencuts and associated smaller water bodies at the abandoned (in 1971) uranium mine at Rum Jungle, Australia. Abundant populations of T. ferrooxidans and autotrophic sulfur-oxidizing bacteria were found in the sediments of the opencuts, indicating the occurrence of microbial degradation of sulfides. Desulfovibrio and T. denitrificans, isolated from the sediments, along with T. ferrooxidans, suggest that the latter may be solubilizing sulfides anaerobically or microaerophilically, using something other than oxygen as a terminal electron acceptor. The dissolved oxygen content of the water column below about 5 meters was low where the largest populations of T. ferrooxidans were found. Water in the opencuts were heavily polluted with sulfuric acid and heavy metals from the action of the bacteria. The smaller water bodies were also heavily polluted by drainage and seepage from the heap-leach pile. (Cassar-PTT)
W87-08412

OIL-SHALE SOLID-WASTE DISPOSAL: ESTIMATION OF EMBANKMENT PHYSICAL STABILITY AND THE MOVEMENT OF WATER AND SOLUTES,
Battelle Pacific Northwest Labs., Richland, WA.
R. E. Wildung, R. Bond, G. Gee, and J. D. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161, as DE83-002006. Price codes: A03 in paper copy; and A01 in microfiche. PNL-SA-10598, July 1982. 43 p, 13 fig, 1 tab, 27 ref. Contract No. DE-AC06-76RL0 1830.

Descriptors: *Fate of pollutants, *Oil shale, *Industrial waste, Shales, Waste disposal, Spoil banks, Solute transport, Infiltration, Evaporation, Drainage, Unsaturated flow.

The basic principles governing the physical stability and movement of water in a retorted shale embankment are reviewed. The principles, incorporated into a conceptual embankment, are used to estimate water movement in a hypothetical situation with simplified construction and closure scenarios and a 30-year climatic exposure. The principal parameters evaluated are initial moisture content and hydraulic conductivity. Estimates of potential evapotranspiration (PET) show that although PET is far greater than precipitation, the rainfall distribution throughout the year results in some water infiltration. The initial moisture content of a pile influences the amount of storage in the embankment. At near initial water saturation levels, drainage occurs after the first year and continues for 30 years. After about 20 years the pile approaches equilibrium, in which the drainage nearly equals the precipitation infiltration. Permeability of shale at different compaction densities also influences water movement. Higher permeability at the surface may produce increased downward flux and in certain instances increased upward flux due to evaporation. Lower permeability at depth may restrict drainage but may also result in reduced storage capacity and perched water tables. (Cassar-PTT)
W87-08413

RADIONUCLIDE SORPTION AND DESORPTION MECHANISMS IN INTERBED/GROUNDWATER SYSTEMS OF THE COLUMBIA RIVER BASALT FORMATION,
Atomics International Div., Richland, WA. Rockwell Hanford Operations.
G. S. Barney.
Available from the National Technical Information Service, Springfield, VA 22161, as DE83-002108. Price codes: A03 in paper copy; and A01 in microfiche. RHO-BW-SA--276P, October 1982. 32 p, 2 fig, 11 tab, 17 ref.

Descriptors: *Fate of pollutants, *Radioisotopes, *Sorption, *Geochemistry, Adsorption, Columbia River, Basalt, Groundwater, Conductivity, Radioactive waste disposal, Waste disposal.

The sorption and desorption mechanisms of key radionuclides (Tc, Np, Pu, Am, Cs, Sr, and Ra) in groundwater-interbed systems of the Columbia River basalt formation were investigated. Sandstone and tuff interbed materials from selected sedimentary interbeds were used in these experiments. The effects of groundwater composition and Eh on radionuclide sorption and desorption on the selected geological solid were studied. Sodium, potassium, and calcium in the groundwater decreases sorption of Cs, Sr, and Ra by ion exchange reactions. Groundwater Eh strongly affects sorption of Tc, Np, Pu, and U since chemical species of these elements containing the lower oxidation states are more extensively sorbed by chemisorption. Effects of radionuclide complexation by groundwater anions on sorption were not observed except for neptunium carbonate (or bicarbonate) complexes and plutonium sulfate complexes. Sorption and desorption isotherms were obtained for sorption of key radionuclides under oxidizing and reducing conditions. The Freundlich equation accurately describes most of these isotherms. Most radionuclides are apparently irreversibly sorbed on each of the geologic solids since the slopes of sorption and desorption isotherms for a given radionuclide are different. This hysteresis effect is very large and will cause a significant delay in radionuclide transport. It, therefore, should be included in modeling radionuclide transport to accurately assess the isolation capabilities of a repository in basalt. (Author's abstract)
W87-08416

CHLORINATED DIOXINS AND DIBENZOFURANS IN PERSPECTIVE.
For primary bibliographic entry see Field 5A.
W87-08471

DESORPTION OF 2,3,7,8-TCDD FROM SOILS INTO WATER/METHANOL AND METHANOL LIQUID PHASES,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. W. Walters, A. Guiseppi-Elie, M. M. Rao, and J. C. Means.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 157-169, 5 fig, 1 tab, 20 ref. EPA Cooperative agreement CR-811743-01-0.

Descriptors: *Path of pollutants, *Desorption, *Dioxin, *Soil contamination, Pollutants, Sorption, Soil organic matter, Soil physical properties, Solvents, Methanol, Mathematical equations, Chlorinated hydrocarbons.

Soil samples collected from a number of sites in the U.S. were found to contain significant levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The extent to which this compound is transported as a result of leaching from soil into groundwater was studied by investigating the sorptive and desorptive behavior of TCDD using soils of various organic carbon contents and a range of equilibrium periods from 1 to 90 days. Water, methanol, toluene, and mixtures of water/methanol and water/toluene were employed as the liquid phase because these solvents are associated with chlorinated hydrocarbon manufacturing processes or because they may be disposed in landfills. The appropriate data and mathematical equations were presented. It was concluded that, even for a relatively simple water/soil system, a number of possible desorption pathways can result which depend, not only on the extent of reversibility of sorption/desorption, but also on the rates of sorption and desorption. (See also W87-08471) (Wood-PTT)
W87-08473

ENVIRONMENTAL MOBILITY OF 2,3,7,8-TCDD AND COMPANION CHEMICALS IN A ROADWAY SOIL MATRIX,
Monsanto Co., St. Louis, MO.
R. A. Freeman, J. M. Schroy, F. D. Hileman, and R. W. Noble.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 171-183, 4 fig, 5 tab, 8 ref.

Descriptors: *Path of pollutants, *Soil contamination, *Dioxin, *Hexachloroxanthene, Industrial wastes, Wastes, Missouri, Soil analysis, Chemical wastes, Chlorinated hydrocarbons.

During the 1970's, Northeastern Pharmaceutical Company and Chemical Company produced hexachlorophene; the undesirable byproduct 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) was also formed. The TCDD was primarily contained in a still bottoms waste which was used for dust control at Times Beach, Missouri. Data was presented on the levels of a cocontaminant, 1,2,4,5,7,8-hexachloroxanthene (HCX) which was identified in the still bottoms waste and in the soil at Times Beach. The results of gas chromatographic separations of the soil samples prepared as described were presented. It was concluded that HCX is a marker for chemical wastes from hexachlorophene production though its usefulness as a marker may be reduced if it is found that HCX biodegrades slowly. It was found that the chemical loading of the cores at Times Beach varied significantly due to a number of physical factors involved in the spraying of the waste material. The concentration profile for TCDD at Times Beach was found to be consistent with an average initial concentration of 18 ppm in the top 1 cm of soil. (See also W87-08471) (Wood-PTT)
W87-08474

SOLUBILITY OF 2,3,7,8-TCDD IN CONTAMINATED SOILS,
Battelle Columbus Div., OH.
D. R. Jackson, M. H. Roulier, H. M. Grotta, S. W. Rust, and J. S. Warner.

IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 185-200, 4 fig, 4 tab, 31 ref. EPA Contract 68-03-3100 and Subcontract EC 59606A.

Descriptors: *Path of pollutants, *Soil contamination, *Dioxin, *Soil chemistry, *Soil physical properties, Missouri, New Jersey, Chemical wastes, Pollutants, Sorption, Chlorinated hydrocarbons.

Previous investigations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) sorption were conducted under idealized conditions; 2,3,7,8-TCDD was spiked as a single compound on uncontaminated soil, the soil mixed with water, and a partition coefficient calculated from measurements of the amount of 2,3,7,8-TCDD in solution. These experimental conditions may not address the chemical and physical reactions of 2,3,7,8-TCDD that occur over an extended time period in the soil environment, particularly when 2,3,7,8-TCDD is a trace contaminant in a complex mixture of other organic chemicals. Therefore, the sorption behavior of ten soils from Missouri and New Jersey contaminated with 2,3,7,8-TCDD more than ten years ago was examined. Water/soil partition coefficients (K sub p) for 2,3,7,8-TCDD were determined and the relationships between K sub p values and soil physicochemical parameters were analyzed. It was concluded that chlorinated and other organic cocontaminants which are insoluble in water and resistant to soil microbial degradation are sorbed to the soil matrix and that these chlorinated compounds as a group greatly influence the partitioning of 2,3,7,8-TCDD between the soil solid-phase and soil water extracts in the contaminated soils. (See also W87-08471) (Wood-PTT)
W87-08475

PRESENCE OF HEXACHLOROXANTHENE AT MISSOURI DIOXIN SITES,
Weston (Roy F.), Inc., Kansas City, KS.
T. S. Viswanathan, and R. D. Kleopfer.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 201-210, 3 fig, 2 tab, 8 ref.

Descriptors: *Soil contamination, *Soil contamination sources, *Dioxin, *Hexachloroxanthene, *Path of pollutants, Industrial wastes, Pollutants, Wastes, Chemical wastes, Chemical reactions, Missouri, Toxins, Waste disposal, Chlorinated hydrocarbons, Hexachlorophene.

The state of Missouri has more than 40 hazardous waste sites containing the toxic compound 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD); most of the areas are related to the waste disposal activities of a 2,4,5-trichlorophenol and hexachlorophene producer in southwestern Missouri. Since hexachlorophene production requires the intermediate production of 2,4,5-trichlorophenol, the waste materials from the hexachlorophene manufacturing process often contain two chlorinated by-products, 1,2,4,5,7,8-hexachloro-9H-xanthene (HCX) and TCDD. Because of its chemical structure, HCX is expected to be toxic so an effort was made to determine the extent of the known HCX contamination of sites known to be contaminated with significant quantities of TCDD. Since HCX is a unique byproduct in the manufacture of hexachlorophene, the presence of HCX in dioxin sites implicated a hexachlorophene producer as the source of the environmental pollution. (See also W87-08471) (Wood-PTT)
W87-08476

DISPOSITION OF TETRACHLORODIBENZO-P-DIOXIN IN SOIL,
Missouri Univ.-Columbia. Environmental Trace Substances Research Center.
J. Palausky, J. J. Harwood, T. E. Clevenger, S. Kapila, and A. F. Yanders.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 211-223, 8 fig, 2 tab, 18 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Soil contamination, *Dioxin, *Vaporization, Pollutants, Soil columns, Solubility, Solvents, Chemical properties, Missouri, Diffusion, Migration, Volatility, Viscosity, Physical properties.

The contamination of sites in Missouri with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is an important environmental issue. Due to the lack of direct experimental data on vapor phase movement of TCDD in soils, a number of assumptions were made in previously formulated models which predicted loss of TCDD from soil from volatilization from soil surfaces. The two important parameters governing the loss from the soil bed are the initial depth profile, which is dependent on the carrier solvents (copollutants), and vapor phase diffusion within the bed. These two aspects were experimentally explored using samples from Times Beach, Missouri, with the objectives of monitoring the effects of carrier medium on depth of migration of TCDD in soil, and determining the extent of vapor phase diffusion in TCDD in soil. Various solvents were tested as carrier copollutants and, in general, the extent of migration was related to the solubility of TCDD in the solvent; however, a direct correlation between solubility and extent of migration was not found. The results indicated that solvent volatility, viscosity, and interaction of soil organic matter as well as other absorption sites play a significant role in the migration of TCDD. Initial depth of migration of TCDD in the soil was found to be an important factor in the fate of the TCDD at the contaminated site since this parameter affects the volatilization losses as well as losses through erosion. (See also W87-08471) (Wood-PTT)
W87-08477

STUDIES ON THE ABSORPTION OF TCDD BY PLANT SPECIES,
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
S. Facchetti, A. Balasso, C. Fichtner, G. Frare, and A. Leoni.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 225-235, 1 fig, 6 tab, 14 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Soil contamination, *Dioxin, *Plant tissues, *Bioaccumulation, Plant physiology, Beans, Corn, Absorption, Uptake, Chlorinated hydrocarbons, Translocation, Pollutants, Roots, Evaporation.

The results of cultivation of maize and beans in pots containing soil doped with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in concentrations ranging from 1 to 752 ppt are presented. The capacity of the higher plants to absorb, translocate, accumulate and possibly eliminate TCDD were explored. Cleaned root samples showed TCDD levels higher than those of the soil in which the crop was grown. No significant increase of TCDD in plant parts above ground was found either as a function of time or with the increase of the pollutant in the soil. The high absorption of TCDD by the roots led to the recommendation that precautions be taken in the consumption of some root vegetables. The contamination of the aboveground parts of the higher plants suggests that it occurs mainly through the evaporation of TCDD from contaminated soils. At the contamination levels of these experiments, the plant uptake is on the order of a few ppt. (See also W87-08471) (Wood-PTT)
W87-08478

DIOXIN: FIELD RESEARCH OPPORTUNITIES AT TIMES BEACH, MISSOURI,
Missouri Univ.-Columbia. Environmental Trace Substances Research Center.
A. F. Yanders, S. Kapila, and R. J. Schreiber.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 237-239, 2 ref.

Descriptors: *Path of pollutants, *Dioxin, *Soil contamination, *Research facilities, *Times Beach, Pollutants, Missouri, Test facilities, Sites, On-site tests, Field investigations.

The city of Times Beach, which is located in eastern Missouri, is the site most extensively contaminated by 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in the state. It is estimated that 60% of all known dioxin-contaminated soil in Missouri is located in Times Beach, and as much as 90% is within 60 miles of that city due to previous spraying of contaminated oil for dust control. The U.S. Environmental Protection Agency and the State of Missouri are purchasing Times Beach and relocating the 800 resident families. Plots will be prepared as detailed and leased for dioxin research. The major objective is to identify and evaluate methods which have the greatest potential for the detoxification of dioxin-contaminated material. (See also W87-08471) (Wood-PTT)
W87-08479

DIOXIN RESIDUES IN FISH AND OTHER FOODS,
Food and Drug Administration, Rockville, MD.
D. Firestone, R. A. Niemann, L. F. Schneider, J. R. Gridley, and D. E. Brown.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 355-365, 6 tab, 21 ref.

Descriptors: *Path of pollutants, *Pollutant identification, *Dioxin, Fish, Foods, Polychlorinated hydrocarbons, Michigan, Great Lakes, Saginaw Bay, Phenols, Phenolic pesticides, Herbicides.

To determine the presence of dioxin residues in food, several other food commodities as well as fish were analyzed for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), and a number of foods of animal origin were analyzed for residues of the higher-chlorinated dioxins present in pentachlorophenol (PCP), including hexa-, hepta-, and octachlorodibenzo-p-dioxin. Particular attention was paid to the commercial fishing industry at Midland, Michigan and to fish collected from Saginaw Bay and the Great Lakes. Ultratrace residues of 2,3,7,8-TCDD in the edible portion of fish from certain Great Lakes areas and other locations appeared to be associated with the production of chlorinated phenol products and the disposal of dioxin-containing wastes. Levels of 2,3,7,8-TCDD in Saginaw Bay fish appeared to be declining steadily since 1979 when Dow Chemical Co. stopped producing 2,4,5-T. No 2,3,7,8-TCDD residues were found in soybeans, rice, and crawfish from rice-growing areas in Arkansas and Louisiana sprayed with 2,4,5-T herbicide. The presence of 2,3,7,8-TCDD in fish did not appear to be widespread, but rather was localized in areas near 2,4,5-trichlorophenol and 2,4,5-T production sites. The presence of higher-chlorinated dioxin residues in eggs and other animal-derived foods collected as market basket samples appeared to be associated with the use of pentachlorophenol in agriculture and industry. (See also W87-08471) (Wood-PTT)
W87-08483

MATHEMATICAL AND STATISTICAL METHODS IN MODELING THE SEVESO DIOXIN EPISODE,
Pavia Univ. (Italy). Dept. of Nuclear Theoretical Physics.
S. P. Ratti, G. Belli, A. Lanza, and S. Cerlesi.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 467-476, 6 fig, 9 ref.

Descriptors: *Path of pollutants, *Seveso, *Dioxin, *Model studies, *Statistical methods, *Data interpretation, Mathematical models, Mathematical equations, Mathematical studies, Statistical analysis, Italy, Industrial wastes.

The accidental release on July 10, 1976 of tetrachlorodibenzo-p-dioxin (TCDD) from a smokestack of the ICMESA plant near Seveso, Italy, is known as the 'Seveso episode' and has been studied extensively. Statistical information from all the data collected between 1976 and 1984 in the area around the factory was analyzed. Appropriate mathematical equations, 'risk maps', and graphic displays are presented. (See also W87-08471) (Wood-PTT)
W87-08489

DESTRUCTION OF DIOXIN-CONTAINING WASTES IN A MOBILE INCINERATION SYSTEM,
Environmental Protection Agency, Kansas City, MO. Region VII.

For primary bibliographic entry see Field 5E.
W87-08490

SEVESO LESSON: ADVANCES IN RECLAMATION AND DISPOSAL TECHNIQUES,
G. U. Fortunati.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 541-553, 4 tab, 20 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Decontamination, *Detoxification, *Waste disposal, *Dioxin, *Seveso, Italy, Industrial wastes, Soil contamination, Soil management, Hazardous materials, Toxins, Cleanup.

The accidental release on July 10, 1976 of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) into the air by an industrial facility contaminated a large area in Italy. Soil reclamation options including incineration, photodegradation, the Gamma-ray method, the ozone method, the solvent extraction method, and the SEA Marconi dechlorination method are presented. The reasons for not using most of the suggested methods of decontamination are detailed. It was found that the more complex the operations planned to handle the contaminated wastes, the higher the risk involved to both the environment and the cleanup workers. The incineration of the removed material in a rotary kiln was considered, but discarded on social and political grounds. Of all the methods proposed and evaluated in the laboratory or in the field between 1977 and 1980, none was judged suitable for the necessary large scale operation. Therefore, the toxic wastes were collected in two basins to prevent further dispersion into the surrounding areas. It is concluded that the early evacuation of the people in the most highly contaminated area and the confinement of the contaminated soil in the basins has reduced the danger to the population even though remedial action is incomplete. (See also W87-08471) (Wood-PTT)
W87-08492

POLLUTION ACROSS BORDERS: ACID RAIN - ACID DIPLOMACY.
New Hampshire Univ., Durham. Dept. of Forest Resources.
Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. Edited by John E. Carroll. 72 p.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Conferences, *Political aspects, *Economic aspects, *Pollutants.

The proceedings of the University of New Hampshire Conference Pollution Across Borders were reported. The international aspects of acid rain were presented along with statements by representatives from Norway, Sweden, the U.S. and Canada. Diplomatic and environmental perspectives were offerred. (See also W87-08498 through W87-08509) (Wood-PTT)
W87-08497

INTERNATIONAL ASPECTS OF ACID RAIN: WHERE DO WE STAND,
Institute of European Environmental Policy, Bonn (Germany, F.R.).
K. von Moltke.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 1-8.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, *Economic aspects, Pollutants, Europe, Environmental protection, Sulfur compounds, Costs.

European aspects of environmental policy regarding acid rain beginning in the early seventies are reviewed. Detailed discussions of why acid rain has developed into an emotive issue, the problems of uncertainty, the need for international approaches to acid rain, the difficulties associated with international action, and some ideas of solutions are presented. It is stressed that air cannot be contained within national boundaries, so control of air pollution must, of necessity, be treated as an international problem in spite of the difficulties of instituting international measures for environmental protection. Internationally, the minimum acceptable goal is a commitment to reduce sulfur dioxide emissions by 30%, though there has been arguement in Europe about the equity of using current emissions as a baseline since some countries have already made more effort to control air pollution than others. Cost is also a major concern. (See also W87-08497) (Wood-PTT)
W87-08498

NORDIC PERSPECTIVE OF ACID RAIN: NORWAY,
Miljoeverndepartementet, Oslo (Norway).
E. Lykke.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 9-15.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Air pollution effects, *Water pollution effects, *Political aspects, *Economic aspects, *Norway, Pollutants, Environmental effects, Sulfur compounds, Fish, Forests.

The purposes and results of a OECD study of the long-range transport of sulfur compounds, which was identified as the most likely source of the air pollution impact on freshwater acidification and its suspected relationship to the depletion of fish stocks are reviewed. As a result of that study the Europeans realized that they had to cope, not only with their own pollution problems, but with their neighbors' contributions to them and it was concluded that international coordination was needed. A Norwegian program was developed to determine the effects of air pollution on forests and freshwater with emphasis on changes in water chemistry, soil composition, interactions between depositions, soil processes and fish biology; the conclusions agreed with those of the OECD study. Various other studies are reviewed. The 1983 joint decision of Norway, Sweden and Finland to each reduce sulfur emissions by at least 30% by 1993, taking 1980 emissions as a basis for the calculations, and the estimated results of the action are discussed. A total of 18 countries subsequently made the same comittment. It is concluded that, although action is finally being taken, improvements in research and monitoring efforts must be made. (See also W87-08497) (Wood-PTT)
W87-08499

NORDIC PERSPECTIVE OF ACID RAIN: SWEDEN,
Royal Ministry for Foreign Affairs, Stockholm (Sweden).
L. Bjorkbom.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 16-21.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, Economic aspects, Pollutants, Europe, Environmental protection, Sulfur compounds, Costs.

The West German change of policy in 1982 from actively trying to stop progress in the efforts to reduce sulfur dioxide emissions to actively supporting national and international action in the same field is described and possible political explanations are given. Internal politics which put Sweden in the forefront of the campaign for international action against acid rain are also summarized. The decision by governments of whether to fight acid rain or disregard its existence is a political one; calculated cost/benefit analyses, deposition effect studies or economic feasibility of control technologies are used only afterwards as support for arguements for or against legislation. Embarrassment has also been used politically to shame nations into following the example of those which already committed themselves to the suggested 30% reduction in sulfur dioxide emissions. Possible arguements which might prove to be more effective in negotiations with the British and the Americans are detailed. (See also W87-08497) (Wood-PTT)
W87-08500

EUROPEAN NATIONAL RESPONSES TO THE EXPANDING PROBLEM OF ACID RAIN,
Pioneer Foundation, Inverness, CA.
A. Rosencranz.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 22-36.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Air pollution effects, *Water pollution effects, *Political aspects, Pollutants, Economic aspects, Environmental effects, Sulfur compounds.

The effects of acid rain on private property, drinking water, fish, birds, and forests in various countries are reviewed and the nations providing the largest amounts of the pollutant, sulfur dioxide, are listed. It is theorized that nations act only when it is in their national self-interest to do so which explains the order in which nations joined the campaign for acid rain abatement; the victimized countries like Norway and Sweden joined early and others later as the officials recognized the implications for their countries. Economics plays a significant role in the 'national interest theory'. The case study of the United Kingdom whose policy appeared to be one of waiting until the control technology became cheaper or the damage increased, is presented. The control strategies of the European countries most deeply implicated in the acid rain problem including Sweden, Norway, West Germany, United Kingdom, France, Italy, Greece, Switzerland, Austria, Denmark, Netherlands, Poland, Czechoslovakia, and East Germany are summarized. (See also W87-08497) (Wood-PTT)
W87-08501

CANADIAN DIPLOMATIC PERSPECTIVE OF ACID RAIN,
Consul General of Canada in New England, Boston, MA.
B. J. Danson.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 37-40.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, Economic aspects, Pollutants, Canada, United States, Environmental protection, Sulfur compounds, Costs.

Canada's position on acid rain is based on a public and political concensus without political or regional barriers. The debate in Canada is centered around questions of speed in achieving the agreed upon objectives. However, it is pointed out that no matter how effective the Canadian programs may be in reduction of acid depositions, they cannot control the transborder emissions which account for at least 50% of the depositions. Talks between the U.S. and Canada began in 1978 in response to a resolution of the U.S. Congress calling for a Canada/U.S. Transboundary Air Poluution Agreement which led to a memorandum of intent in 1980 under which valuable work has been accomplished. In 1982 the administration rejected the proposed target of 50% reduction in deposition. The Canadians are porceeding to implement their program and are disappointed in the reluctance of the U.S. to take action to alleviate the shared problem. (See also W87-08497) (Wood-PTT)
W87-08502

U.S. EPA PERSPECTIVE OF ACID RAIN,
Environmental Protection Agency, Washington, DC.

F. Green.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 41-44.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, Economic aspects, Pollutants, Canada, United States, Environmental protection, Sulfur compounds, Costs.

The U.S. Statement made in Munich at the conference held there dealing with acid rain was repeated. It acknowledged the acid deposition problem and described the air pollution control measures undertaken by the U.S. to reduce the emissions of sulfur dioxide and nitrogen oxides. Significant financial investment was made and major sucesses were cited. However, the Statement claims that more research was needed to fill the gaps in the knowledge before a control strategy or policy decision could be reached. The speaker concluded by saying that discussions are ongoing and that Canada and the U.S. should be able to deal with the acid rain problem in a practical and environmentally sound way. (See also W87-08497) (Wood-PTT)
W87-08503

US DIPLOMATIC PERSPECTIVE OF ACID RAIN,
Department of State, Washington, DC. Office of Canadian Affairs.
W. Millan.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 45-49.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, Economic aspects, Pollutants, Canada, United States, Environmental protection, Sulfur compounds, Costs.

The Department of State concentrates on the acid rain problem as a political or economic issue leaving the scientific gathering of information to environmental scientists. Recent developments as a result of the Memorandum of Intent with Canada are listed and a summary of the policy review calling for additional research is given. It is claimed that in the face of the scientific uncertainty, the difficult issues of equity and fairness, and the enormous costs, the decision of the U.S. not to accept the proposition that additional measures be taken over and above the ones being taken presently is constantly being reviewed. Ongoing communication with Canada is expected. (See also W87-08497) (Wood-PTT)
W87-08504

ENVIRONMENT CANADA PERSPECTIVE OF ACID RAIN,
Environmental Protection Service, Ottawa (Ontario).
J. Davies.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 50-56.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Air pollution effects, *Political aspects, Economic aspects, Pollutants, Canada, United States, Environmental protection, Sulfur compounds, Fish, Lakes, Costs, Environmental effects, Soil contamination, Drinking water.

The effects of acid rain including those on lakes, fish, soil acidity, and drinking water are reviewed. Scientific facts about the sources of the pollutants are presented briefly before an explanation of Canada's acid rain control program is detailed. The two-phase program whose objective is to limit acidic deposition to less than 20 kilograms per hectare per year was established and is being implemented by use of regulations curtailing emissions with specific reductions by given dates. Canadian smelting operations and thermal power stations emitting sulfur dioxide are affected. However, is is also emphasized that the Canadian acid rain problem cannot be solved by Canada alone because of the contributions by U.S. pollution sources. The Memorandum of Intent to negotiate a transboundary air pollution agreement was reviewed. Costs are blamed for the U.S. procrastination especially since the cost must be paid by one jurisdiction while the benefits are received in another. (See also W87-08497) (Wood-PTT)
W87-08505

GOVERNOR'S PERSPECTIVE ON ACID RAIN,
National Governor's Association, Washington, DC. Acid Rain Task Force.
J. Sununu.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 57-60.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, Legislation, Public paricipation, Economic aspects, Pollutants, United States, Environmental protection, Sulfur compounds, Costs.

The problems associated with determining who pays for reducing the emission of pollutants causing acid rain need to be addressed on a national level with legislation at the Federal level because of the interstate relationships involved. Some possible solutions are presented along with the political reasons that they would fail. It is suggested that a strong showing of public opinion both in the U.S. and Canada is necessary before any positive action takes place. (See also W87-08497) (Wood-PTT)
W87-08506

VERMONT PERSPECTIVE ON ACID RAIN,
Vermont State Agency of Environmental Conservation, Montpelier.
B. Whittaker.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 61-64.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, Economic aspects, Pollutants, Canada, United States, Environmental protection, Forests.

It is claimed that Vermont's single potentially largest problem in the environmental area is the long-range transport of air pollutants. The twelve-year history of the annual meetings of the New England Governors and the Eastern Canadian Premiers was reviewed and the issues discussed are presented. A final agreement recommended that the limit of 20 kilograms per hectare per year of acid deposition be adopted by both countries. Professionals on both sides of the border are unified in their demand that both national governments recognize the problem and work on a solution for the North American Continent. In New England, the effects of acid rain on forests are a major concern. (See also W87-08497) (Wood-PTT)
W87-08507

ONTARIO PERSPECTIVE ON ACID RAIN,
Ontario Ministry of the Environment, Rexdale.
W. Giles.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 65-69.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, Communication, Pollutants, Canada, United States, Environmental protection.

The transboundary transport of air pollutants from the U.S. to Canada and the resulting acid rain is discussed. The importance of continuing communication is stressed. Canada's emission control programs are discussed, and the observation that Canadian efforts alone cannot solve the problem is repeated. (See also W87-08497) (Wood-PTT)
W87-08508

CONGRESSMAN'S PERSPECTIVE ON ACID RAIN,
N. D'Amours.
IN: Pollution Across Borders: Acid Rain - Acid Diplomacy, Proceedings of a Conference, September 12-14, 1984. Department of Forest Resources, University of New Hampshire, Durham, NH. 1984. p 70-72.

Descriptors: *Acid rain, *Air pollution, *Rainfall, *Path of pollutants, *Political aspects, U.S. Congress, Pollutants, Canada, United States, Environmental protection.

The political aspects of the transboundary, international transport of air pollutants and acid rain are discussed. The congressman claims that Congress is very limited, both by its structure and by its expertise in what it can do to participate; this sort of problem is usually handled by the Administration, by the State Department, and by various bureaucacies, EPA, and others within the Administration. Citizens are called to exert their influence and the Administration to exert strong national leadership since Congress will remain divided on the environmental issue of sulfur dioxide because each Congressman must defend the needs of his constituents. (See also W87-08497) (Wood-PTT)
W87-08509

GLYPHOSATE-SEDIMENT INTERACTIONS AND PHYTOTOXICITY IN TURBID WATER,
Commonwealth Scientific and Industrial Research Organization, Campbell (Australia). Inst. of Biological Resources.
K. H. Bowmer, P. M. D. Boulton, D. L. Short, and M. L. Higgins.
Pesticide Science PSSCBG, Vol. 17, No. 2, p 79-88, April 1986. 5 fig, 5 tab, 18 ref.

Descriptors: *Water pollution effects, *Glyphosate, *Sediments, *Phytotoxicity, *Herbicides, *Turbidity, *Irrigation water, *Path of pollutants, Toxicity, Pesticides, Physical properties, Irrigation, Irrigation practices, Adsorption, Suspended sediments, Roots, Growth, Contamination, Drainage.

Two aspects of glyphosate use and safety are reported: (1) the elution of glyphosate from sediment contaminated incidentally during application to weed foliage after channel drainage; and (2) the adsorption of glyphosate onto benthic sediments during transport downstream. Results of two experiments showed that only a minor proportion of glyphosate was adsorbed onto suspended solids, even in turbid water. Phytotoxicity to safflower was not significantly reduced. When glyphosate was injected into flowing water of contrasting quality to simulate incidental contamination, adsorption by benthic sediments attenuated the loads slowly; attenuation was 13-27% per km as compared to 31% observed previously. However, when glyphosate was sprayed onto sediment exposed after channel draining, less than 7% of the glyphosate applied was subsequently eluted. Therefore, draining before treatment would be an effective strategy for minimizing contamination of irrigation water. (Author's abstract)
W87-08510

TREND DETERMINATION OF POLLUTION LOAD AT DIFFERENT DISCHARGES BY THE EXAMPLE OF HEAVY METAL CONCENTRATIONS IN SUSPENDED SEDIMENTS (TRENDERMITTLUNG BEI UNTERSCHIEDLICHEN ABFLUESSEN AM BEISPIEL DER SCHWERMETALLGEHALTE VON SCHWEBSTOFFEN),
Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.).
H. Hellmann.
Zeitschrift fuer Wasser- und Abwasser Forschung ZWABAQ, Vol. 20, No. 1, p 1-5, February 1987. 14 fig, 1 tab, 5 ref.

Descriptors: *Pollution load, *Heavy metals, *Suspended sediments, *Statistical analysis, Graphical analysis, Streams, Rhine River.

The trend of pollution load in streams cannot be determined on the basis of annual mean values. It seems appropriate to work out first a concentration/discharge relationship from which the data for selected standardized discharge values (MNQ, MQ, MHQ, respectively: mean low-, mid- and high-water values) may be obtained in order to set up the actual trend curve. The proposed method is described by example of the undissolved heavy metals cadmium, chrome, copper, lead and zinc for the Rhine at Koblenz during the period 1973 to 1984. (Author's abstract)
W87-08525

EFFECT OF URBANIZATION ON THE GROUNDWATER OF LIMESTONE ISLANDS: AN ANALYSIS OF THE BERMUDA CASE,
Public Works Dept., Hamilton (Bermuda).
J. A. M. Thomson, and S. S. D. Foster.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 6, p 527-540, December 1986. 8 fig, 9 ref.

Descriptors: *Urbanization, *Nitrates, *Water pollution sources, *Solid waste disposal, *Bermuda, *Sanitation, Aquifers, Coliforms, Oil pollution, Agricultural runoff, Sewers, Limestone.

Bermuda obtains 4500 cu m/day of fresh groundwater from the central lens of a small limestone aquifer, which has been intensively developed and monitored. For this reason the Bermuda experience is most relevant to the process of urbanization on all limestone islands and peninsulas. Risks to groundwater quality include solid waste disposal, oil discharge, and contamination from agricultural practices. Because much of the population of Bermuda lives above the lens and has unsewered sanitation, this represents the major pollution threat. Infiltration from unsewered sanitation plays a critical role in supporting the groundwater abstraction and alleviating salinity in the freshwater lens, since it includes virtually all rainfall caught on roofs. This has led to increasing groundwater nitrate concentrations of up to 40 mg NO3-N/l in the most densely populated area. In the Bermuda case, however, centralized groundwater mixing and treatment from a large wellfield permit a product conforming to WHO guidelines. The highly porous nature of much of the limestone and its surprisingly thick unsaturated zone appear to be generally effective in eliminating fecal coliform bacteria. Where the unsaturated zone is thin, groundwater supplies must be regarded microbiologically as equivalent to lightly polluted surface water for treatment purposes. Further investigation is under way on the fate of viruses and community chemicals. (Author's abstract)
W87-08532

TREATMENT AND DISPOSAL OF WASTEWATERS FROM SETTLEMENTS AND TOURIST RESORTS IN THE MEDITERRANEAN COAST - STATE OF THE ART REVIEW,
Zagreb Univ. (Yugoslavia). Faculty of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-08541

VIRAL POLLUTION OF COASTAL WATERS RESULTING FROM THE DISPOSAL OF UNTREATED SEWAGE EFFLUENTS,
Institut Pasteur Hellenique, Athens (Greece). Dept. of Virology.
V. Krikelis, P. Markoulatos, and N. Spyrou.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 43-48, 1986. 1 fig, 2 tab, 21 ref. Ministry of Research and Technology Research Project 81082.

Descriptors: *Pollutant identification, *Viruses, *Water pollution sources, *Water pollution, *Coastal waters, Wastewater, Raw wastewater, Effluents, Domestic wastes, Enteroviruses, Coxsackie Virus, Pollution load.

The viral pollution of environmental waters results primarily from the discharge of domestic wastewaters which carry human enteric viruses. The viral load of sewage effluents, before their treatment for virus removal, over a thirteen-month period was studied. The maximum viral load detected during the study period was 880 viral cytopathic units per liter of sample. This was recorded in the month of November 1983. Out of 236 randomly selected field-isolates, the following serotypes were distinguished as types: all three Polio, four Coxsackie B, three Echo and six Adeno. The serotypes with the highest frequency were Polio II, Coxsackie B4, and Adeno 7. (Author's abstract)
W87-08543

CONTROL OF POLLUTION FROM RIVER DISCHARGES IN THE MEDITERRANEAN,
Michigan Univ., Ann Arbor. School of Public Health.
For primary bibliographic entry see Field 5G.
W87-08561

SELF-PURIFICATION CAPABILITY OF KARST UNDERGROUND WATERCOURSES WITH RESPECT TO THE POLLUTION OF THE MEDITERRANEAN SEA,
Andrija Stampar School of Public Health, Zagreb (Yugoslavia).
N. Preka, N. Preka-Lipold, I. Avdagic, and B. Kurpjel.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 257-265, 1986. 4 fig, 2 tab, 5 ref.

Descriptors: *Groundwater pollution, *Path of pollutants, *Fate of pollutants, *Self-purification, *Karst hydrology, *Karst, *Underground streams, *Groundwater, Mediterranean Sea, Watercourses, Yugoslavia, Biological oxygen demand, Pollution load, Organic loading, Mathematical equations, Tracers.

The results of the organic self-purification process that occurs in karst underground watercourses are reviewed. The investigations were carried out in two test reaches between 1974 and 1984. The first reach comprised the underground section of a river in an area of shallow karst in Slovenia, while the second was in the deep karst area of Eastern Herzegovina. The fundamental studies of the change in the BOD loadings showed the value of the oxygen consumption rate coefficient in karst groundwaters, transferred to a temperature of 20 C, to be k sub 1 (r) = 0.160 to 0.210. To determine the change in loadings, the Upstream-downstream method was applied, while the travel time was defined using a tracer. An identical value of the deoxygenation coefficient was found when observing the changes in the daily loads at the exit profile only. This knowledge enables the practical application of coefficient k sub 1 to estimate the input level of karst springs and coastal sea protection. (Author's abstract)
W87-08563

PRINCIPLES AND CRITERIA FOR THE PROTECTION OF WATER AGAINST POLLUTION FROM HOSPITALS IN THE MEDITERRANEAN COASTAL REGION,
Institute of Public Health, Zagreb (Yugoslavia).
J. Cicek.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 267-272, 1986. 7 ref.

Descriptors: *Water pollution sources, *Hospitals, *Path of pollutants, *Wastewater disposal, *Wastewater discharge, *Coastal waters, Mediterranean Sea, Water pollution, Design criteria, Environmental impact statement, Wastewater.

The characteristics of hospitals and their ecological influence regarding water and sea pollution are discussed. Suggestions are given referring to the principles and criteria that could be used in the design and construction of hospitals and other medical facilities, when aiming to protect water against pollution. It was concluded that it is necessary that the existing medical buildings in the coastal part of the Mediterranean area have suitable methods of dealing with their wastewaters not only from ecological and economic points of view, but also for hygenic and epidemiological reasons. Those medical facilities lacking adequate wastewater treatment must implement solutions in phases and with the cooperation of community wastewater treatment facilities. The outlined principles and criteria should be used in environmental impact assessment studies and should facilitate the decision-making processes. (Wood-PTT)
W87-08564

POLLUTION OF THE BEACHES OF ALEXANDRIA DUE TO THE DISCHARGE OF SEWAGE: A CASE STUDY,
Alexandria Univ. (Egypt). Dept. of Environmental Health.
F. El Sharkawi.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 273-278, 1986. 2 fig, 4 tab, 4 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Wastewater disposal, *Water pollution effects, *Public health, *Coastal waters, *Alexandria, Egypt, Tourism, Recreation, Beaches, Typhoid, Municipal wastewater, Outfall sewers, Outfall, Wastewater outfall, Epidemiology.

Alexandria is the main summer resort of Egypt. The population of the city is about 3 million and in the summer it receives about a half a million tourists who come to its beaches for recreation. Part of the city sewage is discharged into the sea through some outfalls along the coast. A coastal line of about 20 kilometers in length was monitored in order to study the pollution of the recreational waters. Also, a retrospective epidemiological study was carried out to find if there was a relation between the state of pollution and the occurrence of typhoid among bathers. The results of this study showed that there was a significant risk of contracting typhoid from bathing in the heavily polluted water and that the young age group was most affected. Therefore, it was recommended that the minor outfalls be closed immediately to protect the public health, and that a long outfall be constructed as recommended by the Master Plan as quickly as possible. (Author's abstract)
W87-08565

PRELIMINARY RESULTS OF THE JOINT ITALIAN-YUGOSLAV RESEARCH PROGRAM ON THE POLLUTION OF THE ADRIATIC SEA,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
D. Degobbis, E. Accerboni, and P. Franco.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 293-302, 1986. 1 fig, 2 tab, 40 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Adriatic Sea, *Pollutant identification, *Coastal waters, Pollutants, Water pollution, Pollution index, Physical properties, Biological properties, Chemical properties, Sedimentology, Monitoring, Data collections, Data acquisition, Model studies.

The research of the 'Joint Italian-Yugoslav Commission for the Protection of the Adriatic Sea and Coastal Regions from Pollution' began in 1979. To date, five cruises were conducted on a grid of 42 stations covering the open waters of the northern and middle Adriatic, and basic physical, chemical, biological and sedimentological characteristics, as well as specific pollutant concentrations, were established and monitored (75 parameters in all). Other activities undertaken as subprojects, included the development of computerized banks for the collected data and relevant bibliography, and the elaboration of hydrodynamical and interactive models. The preliminary results are summarized and discussed in the light of the objectives of the joint research. (Author's abstract)
W87-08567

EUTROPHICATION OF COASTAL WATERS - GULF OF TRIESTE,
Trieste Univ. (Italy). Ist. di Idraulica.
R. Olivetti, J. Faganeli, and A. Malej.
Water Science and Technology WSTED4, Vol.

18, No. 9, p 303-316, 1986. 5 fig, 4 tab, 23 ref.

Descriptors: *Eutrophication, *Water pollution, *Water pollution sources, *Fate of pollutants, *Path of pollutants, *Pollutant identification, *Coastal waters, *Gulf of Trieste, Algal growth, Algae, Aquatic environment, Degradation, Data interpretation, Data acquisition, Monitoring, Dissolved oxygen, Chlorophyll, Oligotrophy, Bay of Muggia, Limnology.

The OECD (1982) definition of 'eutrophication' which is 'undesirable degradation of the aquatic environment caused by an excessive algal biomass resulting in a deterioration of water quality which interferes with most of the beneficial uses of water; it is causing, in many cases, significant economic losses' is used. To achieve an evaluation of the relevance of this problem in the Gulf of Trieste, the main results of extensive chemical and biological monitoring carried out both by the Yugoslav and Italian sides in the last decade are briefly reviewed. The large amount of data on dissolved oxygen, transparency, chlorophyll, and on the obnoxious occurrence of colored waters, indicate that the great majority of the Gulf waters are not affected by eutrophication according to the adopted definition; rather, the major part of the eastern (Yugoslav) waters appears to be essentially oligotrophic. Strong eutrophication, however, sometimes affects the inner part of semi-enclosed bays where large quantities of organic matter and nutrients are discharged. Such areas, such as the inner part of the Bay of Muggia, are severely polluted in many respects. A better form of treatment and disposal of sewage from Trieste (which is polluting the Bay of Muggia) would be advisable, and would also achieve amelioration of the trophic levels in areas laying outside the bay. (Wood-PTT)
W87-08568

SEEPAGE INTO VARIABLY SATURATED POROUS MEDIUM,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2G.
W87-08584

SCREENING METHOD FOR CONTAMINANT PLUME CONTROL,
Illinois State Water Survey, Champaign. Ground-Water Section.
J. M. Shafer, and L. W. Vail.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 336-352, May 1987. 9 fig, 2 tab, 14 ref.

Descriptors: *Path of pollutants, *Groundwater pollution, *Plumes, *Pumping rate, *Mathematical studies, Algorithms, Flow, Pumping, Groundwater, Screening, Estimating.

In many cases, mitigation of the impact of localized groundwater contamination can be achieved, or enhanced, by using groundwater withdrawal and/or injection to control plume migration. However, for complicated flow domains, where multiple wells are required, the determination of the pumping rates necessary to achieve a specific plume manipulation objective is nontrivial. A relatively simple and flexible methodology is presented for initial screening estimation of pumping rates that will achieve plume manipulation objectives. Plume manipulation objectives are formulated as unconstrained nonlinear minimization problems using penalty function methods. For solution, a nonlinear mathematical programming algorithm is loosely coupled to a finite difference simulator of the hydraulic response of the flow domain to pumping and a numerical integration routine for plume tracking. (Author's abstract)
W87-08592

5C. Effects Of Pollution

EFFECTS OF MICROCOSM SALINITY AND ORGANIC SUBSTRATE CONCENTRATION ON PRODUCTION OF VIBRIO CHOLERAE ENTEROTOXIN,
Maryland Univ., College Park. Dept. of Microbiology.
M. L. Tamplin, and R. R. Colwell.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 297-301, August 1986. 3 fig, 2 tab, 18 ref. WHO Grant C6/181/70(A), AID Grant DPE-5542-G-55-4060-00, and PHS Grant R22, A1-14242.

Descriptors: *Salinity, *Organic compounds, *Substrates, *Toxins, *Vibrio, *Public health, *Bacterial physiology, Physiological ecology, Bacteria, Aquatic bacteria, Pathogenic bacteria, Seawater, Diseases, Human diseases, Chemical properties, Physical properties, Biological properties, Microbiological studies, Nutrients.

The effects of aquatic processes on production of cholera toxin by Vibrio cholerae were studied with seawater microcosms using several salinity and organic nutrient concentrations. Cholera toxin was detected using a modified enzyme-linked immunosorbent assay (ELISA). At 10 g of organic nutrient per liter of seawater, toxin production increased as the salinity was increased. At lower organic nutrient concentrataions, toxin production was markedly enhanced when the salinity was 20 and 25%. Toxin concentration increased with salinity independent of cell concentration and toxin stability. It is concluded that physical and chemical parameters of the aquatic environment affect not only the physiological state of V. cholerae, but also its potential pathogenicity. (Author's abstract)
W87-07598

PHENOTYPIC AND GENOTYPIC ADAPTATION OF AEROBIC HETEROTROPHIC SEDIMENT BACTERIAL COMMUNITIES TO MERCURY STRESS,
California Univ., Irvine. Environmental Analysis Div.
T. Barkay, and B. H. Olson.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 403-406, August 1986. 1 fig, 1 tab, 19 ref.

Descriptors: *Limnology, *Adaptation, *Aerobic bacteria, *Heterotrophic bacteria, *Lake sediments, *Mercury, *Physiological ecology, *Water pollution effects, Bacteria, Sediments, Lakes, Heavy metals, Contamination, Microbiological studies, Stress, Pollutants, Water pollution.

The effects of mercury contamination of Onandaga Lake (NY) sediments on the phenotypic and genotypic mercury resistance of the indigenous heterotrophic aerobic bacterial communities were investigated. Strong positive correlations between mercury sediment concentration and the frequency of the gene coding for mercury volatilization (mer) ($r = 0.96$) or the phenotypic mercury resistance ($r = 0.86$) of the studied communities suggested that the inheritance via selection or genetic exchange of the mer gene had promoted bacterial adaptation to mercury. Failure to detect the mer gene in one mercury-contaminated sediment where phenotypic expression was low suggested that other mechanisms of resistance may partially determine the presence of mercury-resistant organisms in mercury-contaminated sediment or that the mercury in this particular sediment was very chemically limited in its availability to the microorganisms. (Author's abstract)
W87-07602

EFFECT OF SMELTING OPERATIONS ON PEATLANDS NEAR SUDBURY, ONTARIO, CANADA,
Alberta Univ., Edmonton. Dept. of Botany.
L. D. Gignac, and P. J. Beckett.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 6, p 1138-1147, June 1986. 21 fig, 7 tab, 38 ref.

Descriptors: *Smelting, *Water pollution effects, *Ontario, *Peat bogs, *Heavy metals, *Ecological effects, Metallurgy, Bogs, Mineral industry, Copper, Nickel, Manganese, Aluminum, Iron, Calcium, Metals, Accumulation, Vegetation, Vegetation effects, Environmental effects, Shrubs, Mosses, Distribution patterns, Growth.

Accumulations of six metals (Cu, Ni, Mn, Al, Fe, and Ca) were analyzed in peat and water for 18 peatlands east-northeast of Falconbridge, Ontario. The peatlands had a minimum of 30 cm accumulation of peat, $<$ 10 micrograms per ml Ca(2+) in the water, and were from a variety of physiognomic dominance types. Significant correlations existed between the distance from smelting operations and the concentrations of Cu and Ni in the peat and water. Levels of Mn, Fe, and Ca were not related to distance. The vegetation was analyzed on 11 of the 18 peatlands. With the exception of the two sites closest to the smelter, all are low shrub peatlands, dominated by Chamaedaphne calyculata. Effects on the vegetation range from severe within 2 km of the smelter to minimal at 30 km. Sphagnum species that normally dominate the moss layer of the peatlands begin to appear at approximately 12 km from the smelter and are found almost exclusively in the moat area. With increasing distance and decreasing concentrations of Cu and Ni, conditions gradually permit growth of the oligotrophic Sphagnum species. Beyond 30 km, Sphagnum dominates all portions of the peatlands. (Author's abstract)
W87-07603

CONTAMINANT EFFECTS ON FISHERIES.
Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch.
John Wiley and Sons, New York, New York. 1984. 333p. Edited by Victor W. Cairns, Peter V. Hodson, and Jerome O. Nriagu.

Descriptors: *Limnology, *Water pollution effects, *Fisheries, *Great Lakes, *Fish population, Environmental effects, Stress, Information exchange, Toxicology, Fish physiology, Lakes.

There are some data indicating that Great Lakes fish are responding to chemical stress. As early as 1964 biologists from New York State reported that DDT in lake trout eggs was affecting lake trout reproduction. Since that time, strong circumstantial evidence has implicated chemical contaminants with fish and herring gull reproductive failures, physiological dysfunction, and epizootics of benign and malignant tumors in some fish species. Cause and effect relationships are difficult to establish in wild populations and many of the stress responses, particularly at the population and community levels, are common to both chemical and nonchemical stressors. The absence of hard data describing the effects of contaminants on Great Lakes fish reflects the current state of knowledge. The Great Lakes Fishery Commission recognized this problem and hosted a workshop to discuss suitable methods for assessing the effects of contaminants on wild fish populations. Toxicologists and fisheries biologists from Canada and the United States were invited to present their own work and recommend promising avenues of research. Some of their presentations and suggestions have been incorporated into this book. The first two chapters provide background to Great Lakes chemical and fisheries problems and introduce the basic concepts of epidemiology. These are followed by descriptions of histological, biochemical and physiological responses to chemical exposure. The final chapters discuss the utility of population and community indicators of chemical and natural stressors. (See also W87-07632 thru W87-07651) (Lantz-PTT)
W87-07631

GREAT LAKES FISHERIES AND ENVIRONMENTAL ISSUES,
Department of Fisheries and Oceans, Owen Sound (Ontario). Great Lakes Fisheries Research Branch.
M. G. Johnson.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 1-7, 17 ref.

Descriptors: *Limnology, *Water pollution effects, *Great Lakes, *Fisheries, *Research priorities, Environmental effects, Toxicity, Water quality, Heavy metals, Organic compounds, Industrial wastes, Fish, Ecosystems, Lakes.

The Great Lakes ecosystem is home to 37 million people, 33% of the population of Canada and 14%

of the population of the United States; 5% of the land area is urban. The population is expected to rise to 60 million people by 2020. Industrial and municipal growth is projected to rise accordingly, mostly centered on the largest urban areas - the south end of Lake Michigan, western Lake Erie and Lake St. Clair from Sarnia to Cleveland, and western Lake Ontario from the Niagara Frontier to Oshawa. The Great Lakes Water Quality Board Annual Report for 1977 listed 825 major municipal and industrial wastewater dischargers in the basin. There are approximately 4000 liquid and solid waste disposal sites. The Water Quality Board, in 1978, listed 381 organic and heavy metal contaminants that have been identified as present in the Great Lakes, and 38 additional contaminants were identified in 1979. At present, there are 89 thermal electric generating stations, rated at 54,000 MW, that use water directly from the Great lakes, equivalent to about one-third of the flow of the St. Lawrence River. Seventeen new plants with a combined capacity of 31,000 MW are planned. The Great Lakes Fishery Commission's interest in toxic substances and other environmental issues has matured over the last 10 years, and it continues to strengthen. The following five points attempt to capture research needs most frequently cites by experts: (1) Agencies responsible for fisheries management must pursue a strategy of 'ecosystem epidemiology' based on clinical fish health and improved methods of fish stock and forage base assessment; (2) contaminants research is reactive by nature, responding to issues on a crisis basis; (3) research is needed to develop protocols for integrating laboratory and field studies and to establish correlations between adverse effects in the laboratory and adverse effects in this field; (4) more research is needed to identify chemical fate and construct mass balances of contaminants in the Great Lakes ecosystem; and (5) more research is needed describing the effects of contaminants on Great Lakes invertebrates, particularly zooplankton which are more diverse, easier to test and in many cases more sensitive than fish to environmental contaminants. (See also W87-07631) (Lantz-PTT)
W87-07632

EPIDEMIOLOGY OF DISEASES IN WILD FISH POPULATIONS,
Idaho Univ., Moscow. Dept. of Fish and Wildlife Resources.
G. W. Klontz.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 9-18, 23 ref.

Descriptors: *Fish populations, *Water pollution effects, *Epidemiology, *Fisheries, Fish diseases, Fish physiology, Environmental effects, Fish management.

Episodes of infectious and noninfectious disease in populations of fish are an inescapable factor in fishery resource management. Population structures ebb and flow under their influence. It will only be through increased awareness of the causal factors and their interactions among themselves and with susceptible hosts that resource managers may set attainable goals for population health. To have free-living populations of animals - fish, mammals, birds, or whatever - free of disease is a nice dream but certainly an unrealistic goal at this point in time. Far too little is known about disease per se. In the case of fish, for them to be free of disease is questionable because of their innate irrevocable orientation to their environment. Thus, if the environment changes physically, chemically, or biologically, changes are induced in the fish. These changes are detectable in many cases and often lead to the disease state if the fish is unable to adapt to the change. Application of the principles and techniques of the art and science of epidemiology enable the biomedical researcher to detect these changes, evaluate their effects under controlled conditions, and then, in concert with resource managers, test the laboratory findings under field conditions. The major limiting factor in this entire process is unimaginative thinking. Breakthroughs in problem solving occur out of the interactions of dedicated, imaginative groups comprised of many related disciplines. The fishery resource management discipline has for years tried to ignore the scientific potential of nonfishery scientists from the fields of physiology, pharmacology, biochemistry, and medicine. This era is coming to a close as evidenced by the discipline composition of the group involved in preparing this report. (See also W87-07631) (Lantz-PTT)
W87-07633

USE OF HISTOPATHOLOGY IN AQUATIC TOXICOLOGY: A CRITIQUE,
Wyoming Univ., Laramie. Fish Physiology and Toxicology Lab.
R. D. Johnson, and H. L. Bergman.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 19-36, 1 tab, 23 ref, EPA Cooperative agreement CR808671.

Descriptors: *Water pollution effects, *Histopathology, *Toxicity, Aquatic environment, Field tests, Ecological effects, Environmental effects, Monitoring.

Discussed is the application of histopathology in both laboratory- and field-oriented aquatic toxicology studies. The major objectives of aquatic toxicology studies in the laboratory are to identify mechanisms of toxicity and to predict 'safe' contaminant concentrations in the environment. Identified are two common problems in laboratory approaches as applied by many investigators to either mechanistic or predictive toxicology problems. First, many studies use contaminant problems in the aquatic environment. Second, too few studies correlate structural pathologies with other contaminant effects, such as functional responses that establish toxic mechanisms, or accepted predictors of population-level responses that establish ecological significance. Potential applications of histopathology to aquatic contaminant problems in the field can also be divided into two categories, where the objective is to identify the cause of observed adverse population effects, and monitoring, where the objective is to warn of impending contaminant-caused environmental degradation. Studies that have been performed or contemplated all face of a set of problems: (1) to establish cause-effect relationships, contaminant levels, structural pathologies, and population health must be evaluated in the field simultaneously; (2) immense sample sizes are required for adequate statistical designs in many field studies, especially for effective population stock assessment or for detection of secondary contaminant effects such as disease incidence; (3) without knowing what to look for, histopathologists cannot effectively address field problems. Haphazard 'fishing expeditions' in search of histological lesions are simply inadequate. Laboratory studies should provide the basis for testable hypotheses about specific structural lesions expected in organisms from the field; and (4) parameters must be chosen that can be readily studied in the laboratory. (See also W87-07631) (Lantz-PTT)
W87-07634

BIOCHEMICAL INDICATORS OF STRESS IN FISHES: AN OVERVIEW,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
D. R. M. Passino.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 37-50, 3 fig, 2 tab, 32 ref.

Descriptors: *Water pollution effects, *Bioindicators, *Enzymes, *Fisheries, *Stress, *Fish physiology, Acetylcholinesterase, Delta-amino levulinic acid dehydratase, Adenosine triphosphatase, Leucine aminonaphthylamidase, Fish growth, Electrodes.

During the past two decades, water quality biologists have been searching for sensitive indicators of sublethal effects of contaminants on fish in an attempt to understand the mode of action of toxicants and to develop a basis for corrective action in cleaning up water bodies before the health of aquatic populations is seriously threatened. Enzymes are attractive as indicators because they are more easily quantified than are other indicators, such as changes in behavior. Useful precedents have been set in clinical medicine in the successful diagnosis of disease and evaluation of exposure to industrial chemicals or drugs by analyses of such variables as enzymes, blood chemistry, and liver function. In the fishery field, however, enzyme research is in its infancy: only two fish enzymes have yet been proven to be useful indicators of toxic effects of specific contaminants or classes of contaminants. The first of these enzymes is acetylcholinesterase, which modulates the amounts of the neurotransmitter acetylcholine in the nervous system. The mode of action of malathion, parathion, and other widely use organophosphate insecticides is inhibition of this enzyme. Measurement of acetylcholinesterase in the brains of distressed fish collected in the field has been successfully used to diagnose organophosphate poisoning of fish in the natural waters. The second indicator enzyme is delta-amino levulinic acid dehydratase (ALA-D), which is in the pathway of heme synthesis. Fish exposed chronically to lead suffer from anemia, which is probably a result of the disturbance of hemoglobin synthesis by the blocking effect of lead on ALA-D. Other enzymes discussed here are adenosine triphosphatase, leucine aminonaphthylamidase and mixed function oxidase enzymes. Other indicators of contaminant effects such as: instantaneous growth, bioselective membrane electrode probe, reproductive hormones and bone composition are also presented. (See also W87-07631) (Lantz-PTT)
W87-07635

HEPATIC MIXED FUNCTION OXIDASE (MFO) INDUCTION IN FISH AS A POSSIBLE BIOLOGICAL MONITORING SYSTEM,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
R. F. Addison.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 51-60, 1 fig, 1 tab, 28 ref.

Descriptors: *Water pollution effects, *Bioindicators, *Enzymes, *Aquatic animals, *Fish physiology, Fish, Monitoring, Insecticides, Polychlorinated biphenyls, Gas chromatography, Fluorometry.

Current interest in mixed function oxidase (MFO) enzymes as environmental monitoring tool derives from basic research into detoxification mechanisms begun in the late 1950's. MFO's have been found to be present with relatively low activity in normal animals, where their role seemed to be to degrade endogenous lipophilic substrates such as steroid hormones; however, if the organism is stressed by exposure to various foreign compounds, among which were environmental contaminants such as the insecticide DDT, the polychlorintaed biphenyls (PCBs), or polynuclear aromatic hydrocarbons (PAHs), MFO activity increases dramatically, apparently to enhance the degradation and clearance of the offending compounds. A few reports have described MFO activity and induction in aquatic invertebrates, but in general activity and inducibility appear limited, and activity is reported in tissues or organs that are relatively difficult to obtain. Most studies of the potential of MFO measurements as a monitoring tool have therefore centered on fish liver, which is easier and more rewarding to investigate. Several indices of MFO activity and induction have been studied. Many of the classic indices of MFO activity or induction that have been well-established in mammals either are not well-characterized in fish, or are not particularly responsive to inducers. In fish, proliferation of the smooth endoplasmic reticulum, and the accompanying increase in microsomal protein may not be clearly associated with induction; cytochrome(s) P-450 are not as well characterized as those in mammals, except in a few instances; and MFO activity is usually relatively low so that classic enzymatic reactions, such as aniline hydroxylation, proceed at rates close to their detection limit. Most studies of MFO induction in fish therefore tend to emphasize enzymatic indices, and focus on enzymatic reactions whose products can be detected at very low levels - hence the choice of fluorometric and electron capture-gas chromatographic methods, rather than colorimetric assays.

In the laboratory, MFO induction may represent a quantitative response to graded levels of contaminants; too little is known about its biochemical basis of subtle effects of specific organic contaminants. (See also W87-07631) (Lantz-PTT)
W87-07636

FISH SERUM CHEMISTRY AS A PATHOLOGY TOOL,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
W. L. Lockhart, and D. A. Metner.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 73-85, 4 fig, 4 tab, 18 ref.

Descriptors: *Fish physiology, *Bioindicators, *Water pollution effects, *Fisheries, *Pathology, Stress, Toxicity, Fish parasites, Fish diseases, Environmental effects, Biochemistry.

Fish from a variety of sources ranging from laboratory experiments to field capture have been examined for serum biochemical components. In cases where some type of toxic chemical or disease stressor was known to be acting on the fish, the biochemical measurements consistently separated exposed fish from others not experiencing the known stressor. It has been assumed that the many unknown stressors acting on experimental groups (crowding, handling, parasites, undiagnosed disease, etc.) have been acting on both experimental and control groups, and so should not obscure treatment effects. If the nature of the applied stressor is known, then biochemical responses can suggest possible modes of toxic action; however, if the applied stressor is unknown, then the biochemical analyses are unlikely to allow its unequivocal identification. The use of biochemical methods offers promise in three areas, namely detection of states of stress, suggestion of modes of action, and tentatively as tools to explain the metabolic basis for conventional fishery statistics like growth. A great deal of further work will be needed to derive the statistical and mechanistic relationships linking biochemical characteristics with exposures to specific groups of chemicals or to population characteristics, but the potential seems clearly established. These procedures could be applied as readily to Great Lakes populations as to those reported here, and could provide a basis for agreement on the presence or absence of states of stress, as well as providing clues to explain more conventional fishery production statistics. (See also W87-07631) (Lantz-PTT)
W87-07638

MONITORING LEAD EXPOSURE OF FISH,
Canada Centre for Inland Waters, Burlington (Ontario).
P. V. Hodson, B. R. Blunt, and D. M. Whittle.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p.87-98, 32 ref.

Descriptors: *Water pollution effects, *Lead, *Fish physiology, *Enzymes, Monitoring, Toxicity, Population exposure, Fish, Heavy metals.

Blood lead levels provide a direct measure of the dose accumulated by fish, and hence a reliable measure of their lead exposure. They are also strongly linked to the severity of lead neurotoxicity and hence indicate lead effects. The problems with blood lead monitoring are those of expense, complexity, and sensitivity to sample contamination. Measurements of the inhibition of erythrocyte ALA-D activity of fish are inexpensive, technically simple, rapid, and specific for lead. The extent of inhibition is strongly linked to inorganic lead exposure and to the neurotoxic effects of lead. There are three problems with the measurement of ALA-D activity. First, the enzyme is inhibited by blood lead, which in turn varies with lead exposure; hence ALA-D activity is an indirect, or secondary, indicator of lead exposure. Second, ALA-D activity is inhibited only slightly by alkyllead compounds; therefore activity will not reflect exposure to these compounds. Third, monitoring of ALA-D activity of feral fish has proven only partially successful because: (1) it is necessary to describe the optimum conditions for assaying activity in each species examined; (2) migration of fish confounds clear-cut comparisons between contaminated and uncontaminated sites; (3) contamination by inorganic lead is rarely severe enough to provide a good test of the ALA-D method. Nevertheless, field trials are promising and further research is warranted to realize the advantages of this technique. Other possible indicators of lead exposure are assays of blood porphyrins. While these methods are suitable in human toxicology, studies have been unable to find high porphyrin levels in the blood of control or lead-exposed rainbow trout. Therefore, the effect of lead on hemoglobin metabolism in fish may differ from that in humans. (See W87-07631) (Lantz-PTT)
W87-07639

METALLOTHIONEIN AND ACCLIMATION TO HEAVY METALS IN FISH: A REVIEW,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
J. F. Klaverkamp, W. A. Macdonald, D. A. Duncan, and R. Wagemann.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 99-113, 2 tab, 77 ref.

Descriptors: *Acclimatization, *Water pollution effects, *Metallothionein, *Reviews, *Heavy metals, *Fish, Cadmium, Copper, Lead, Zinc, Mercury, Ecosystems, Research priorities, Ecological effects.

The purpose of this paper is to provide a review of research on the ability of fish to acclimate to heavy metals, on metallothionein (MTN) in fish, and on attempts to correlate these two aspects. Tables are used to summarize information in a concise manner. Humanity's activities release massive amounts of heavy metals into the environment. Global anthropogenic emissions of cadmium, copper, lead, nickel, and zinc into the atmosphere to date have been estimated to be 0.32 times 10 to the 9th kg, 2.2 times 10 to the 9th kg, 20 times 10 to the 9th kg, 1.0 times 10 to the 9th kg, respectively. Anthropogenic emissions of mercury, which mostly arise from mineral processing and fossil fuel combustion, are estimated to be 1 times 10 to the 7th kg/yr. Release of these metals into the atmosphere during the past several decades has resulted in gradual contamination of aquatic ecosystems. Additional research is required to resolve issues in the areas of acclimation and MTN in fish. There is also need to determine biological cost, such as reduced growth, of producing metal acclimation; to understand the importance of other biochemical mechanisms, such as selenoproteins and glutathione; and to establish the relevance of MTN and these other molecules in producing metal-resistant fish populations capable of surviving in contaminated natural ecosystems. To clarify the role of MTN in acclimation to heavy metals by fish, studies designed to correlate rates of acclimation development and decline with rates of MTN synthesis and catabolism, respectively, are required. (See also W87-07631) (Lantz-PTT)
W87-07640

PATHOLOGICAL RESPONSES OF FERAL TELEOSTS TO ENVIRONMENTAL STRESSORS: INTERLAKE STUDIES OF THE PHYSIOLOGY OF GREAT LAKES SALMON,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W87-07641

ADENYLATE ENERGY CHARGE AS A MEASURE OF STRESS IN FISH,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 2H.
W87-07642

ASSESSING THE TOLERANCE OF FISH AND FISH POPULATIONS TO ENVIRONMENTAL STRESS: THE PROBLEMS AND METHODS OF MONITORING,
Seattle National Fishery Research Center, WA.
G. A. Wedemeyer, D. J. McLeay, and C. P. Goodyear.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 163-195, 3 tab, 171 ref.

Descriptors: *Water pollution effects, *Stress, *Fish populations, *Fish physiology, Fish, Environmental effects, Aquatic environment, Adaptation.

Environmental stress is an escapable aspect of life in the aquatic environment. Tolerance to environmental change depends, at least in part, on the individual fish's ability to regulate stabilizing processes that will effect the required physiological or behavioral adaptation. An understanding of the stress response, and the environmental alterations to which fishes can adapt through this response, is important to a definition of the limits of change in the aquatic environment that can be tolerated. Although most species can tolerate relatively severe stress for limited periods because of their homeostatic capabilities, these should not be used as an excuse for allowing marginal conditions to occur in the aquatic environment. Instead, these capabilities should be used to set priorities and limits for species-habitat relationships so that environmental alterations can be correctly evaluated in terms of their biological costs or benefits. This chapter discusses concepts and methods for developing the improved species-habitat data base required to correctly evaluate the tolerance limits of fish and fish populations to single and multiple environmental stress factors. (See also W87-07631) (Lantz-PTT)
W87-07643

EFFECTS OF POLLUTANTS AND CONTAMINANTS ON STEROIDOGENESIS IN FISH AND MARINE MAMMALS,
Department of Fisheries and Oceans, Halifax (Nova Scotia). Fisheries Research Branch.
H. C. Freeman, G. B. Sangalang, and J. F. Uthe.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 197-211, 11 fig, 18 ref.

Descriptors: *Steroidogenesis, *Water pollution effects, *Fish physiology, *Marine animals, *Bioindicators, Toxicity, Chemical analysis, Fish, Lethal limit, Steroids, Hormones.

It is difficult to determine the chronic effects of sublethal quantities of chemical contaminants on an organism, yet these trace quantities are capable of eliminating a species as effectively as a single lethal dose. It is only necessary that a contaminant cause the reproductive capacity of a species to be lowered below maintenance levels or affect a species adversely so its members cannot successfully compete with other organisms in its environment. Early reports of the adverse effects of contaminants on steroidogenesis in vivo and in vitro in fish and marine mammals, have stimulated research on steroid hormone metabolism in fish in search of sensitive indicators of sublethal effects of pollutants. The steroid hormones present in fish and their metabolic pathways are well known. Changes in steroid hormone metabolism can give some insight into physiological changes in fish; in the case of mineralocorticosteroids, osmoregulation; in the case of androgens and estrogens, reproduction; and in the case of adrenocorticosteroids, stress. These changes in hormone metabolism in fish may be useful as an early warning of a problem caused by contaminants. This paper presents some examples of studies in the laboratory on the effects of trace quantitites of chemical contaminants administered in vivo and in vitro on steroid hormone metabolism in fish and in a marine mammal, the seal. (See also W87-07631) (Lantz-PTT)
W87-07644

ASPECTS OF THE ENDOCRINE STRESS RESPONSE TO POLLUTANTS IN SALMONIDS,
Department of Fisheries and Oceans, Vancouver (British Columbia). Fisheries Research Branch.
E. M. Donaldson, U. H. M. Fagerlund, and J. R. McBride.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 213-221,

4 fig, 22 ref.

Descriptors: *Endocrine stress response, *Water pollution effects, *Salmonids, *Fish physiology, Fish, Biochemistry, Hormones.

Endocrine stress response can be used to detect and quantify the acute and chronic effects of water pollutants on fish. The classical stress response described in mammals is essentially an endocrine response to external or internal stressors. The response to stress in the teleost is patterned along the same lines. It is centered around two endocrine systems, the chromaffin tissue, the homologue of the mammalian adrenal medulla, which produces catecholamines, and the interrenal tissue, the homologue of the mammalian adrenal cortex, which produces corticosteroid hormones. The increase in the concentration of these two classes of hormones has been referred to as the primary stress response. This endocrine activity in turn triggers a number of changes in biochemical and physiological parameters termed secondary responses. The determination of plasma catecholamine concentration provides a potential technique for assessment of the primary stress response to pollutants; however, the scope of this paper is restricted to a discussion of the use of the other primary stress parameter, namely the interrenal response, for evaluating the effect of pollutants on fish. Results obtained to date using the Hypothalamus-pituitary-interrenal axis to assess the response of fish to pollutants suggest two avenues of approach for the utilization of this technique. First of all, both plasma cortisol concentration and interrenal nuclear diameter can be used under controlled laboratory conditions to assess whether or not individual xenobiotics or camplex mixtures of pollutants induce an endocrine stress response over a range of concentrations. Secondly, the measurement of interrenal nuclear diameter hsa potential as a field technique for assessment of stress in teleosts. This cytological response is particularly suited to field studies because it is not immediately influenced by the process of fish capture and sampling. The use of plasma cortisol concentration in the field may be possible in those situations where wild fish can be rapidly sampled or where test fish can be carefully exposed in live holding cages. The essential element here is the need for adequate controls held under similar conditions in nonpolluted water. (See also W87-07631) (Lantz-PTT)
W87-07645

COMPARATIVE EPIDEMIOLOGY: THE USE OF FISHES IN ASSESSING CARCINOGENIC CONTAMINANTS,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
R. A. Sonstegard, and J. F. Leatherland.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 223-231, 57 ref.

Descriptors: *Water pollution effects, *Bioindicators, *Carcinogens, *Great Lakes, *Epidemiology, *Fish physiology, Bioaccumulation, Fish, Aquatic environment, Model studies, Monitoring, Polychlorinated biphenyls.

The aquatic environment is one of the ultimate recipients of pollution. Through bioconcentration and bioaccumulation, aquatic biota are often subject to the same or higher levels of chemical pollutants as humans. Therefore, tumor frequencies in aquatic organisms may be sensitive indicators of what the future holds for humanity. Extensive field epizootiological studies of tumor frequencies in fishes inhabiting polluted and nonpolluted waters of the Great Lakes (Superior, Michigan, Huron, Erie, and Ontario). Epizootics of neoplasia that appear to have an environmental etiology were detected in a variety of species. The ability of aquatic organisms to bioaccumulate environmental xenobiotics is well established. Bioconcentration has led to surveillance programs using indicator species to accurately monitor chemical changes in the environment and to identify point-sources of pollutants. This surveillance has also identified dangerously contaminated fish species that has led to legislation controlling their consumption. Further discussion highlights: aquatic organisms as laboratory test animals, new animal models, and the need for environmental monitoring. (See also W87-07631) (Lantz-PTT)
W87-07646

APPRAISING THE STATUS OF FISHERIES: REHABILITATION TECHNIQUES,
Ontario Ministry of Natural Resources, Thunder Bay. Fisheries Research Section.
P. J. Colby.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 233-257, 6 fig, 3 tab, 68 ref.

Descriptors: *Water pollution effects, *Fisheries, *Great Lakes, *Lake restoration, Ecosystems, Fish populations, Bioindicators, Aquatic environment, Environmentl effects.

The need to identify the relative effect of multiple disturbances on a fishery is pressing. In the Great Lakes evidence of changing community structure has been seen associated with exploitation, habitat alteration, and species introduction. The problem is to quantify the relative impact of each individual and combined stress on fish populations and communities. Observations of Great Lakes populations provide only a limited number of the replications necessary to draw relationships. However, the responses of the same species of fishes in smaller lakes is observed, with different stressors, some distinct population responses emerge. In an effort to improve diagnostic capabilities, the response of fish populations to a variety of stimuli is classified. This grouping of responses should help define the current status of a fishery as a reference. Once defined, any unusual departure may suggest the origin of the stressor. The classification of population responses is the primary objective of this paper. An additional objective is to discuss approaches to restructuring fish populations and communities to meet societal needs. (See also W87-07631) (Lantz-PTT)
W87-07647

MODELING APPROACHES FOR ASSESSING THE EFFECTS OF STRESS ON FISH POPULATIONS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
D. S. Vaughan, R. M. Yoshiyama, J. E. Breck, and D. L. DeAngelis.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 259-278, 6 fig, 1 tab, 40 ref, DOI Contract 14-16-0009-80-1039, DOI Intoragency agreement DOE 40-1107-80.

Descriptors: *Model studies, *Water pollution effects, *Stress, *Fish populations, Environmental effects, Mathematical models, Fish, Mathematical studies.

The cumulative effects of multiple stresses on fish populations may cause the collapse of a population, even though the effects of a single stress may be insignificant. Several population modeling approaches are reviewed and compared for their usefulness in quantifying the aggregate effect of multiple sources of stress on populations. Specifically, ways are investigated to insert the effects of stress (multiple or otherwise) into five major modeling approaches: (1) surplus production models, (2) yield or yield-per-recruit models, (3) stock-recruitment models, (4) Leslie matrix models, and (5) bioenergetics models. For each modeling approach, the kinds of data required to implement the basic model and ways that the effects of stress might be incorporated into the model structure are described. The assumptions, advantages, and usefulness of the various modeling approaches are compared. The usefulness of a particular modeling approach for assessing the effects of stress on fish populations is determined by: (1) the applicability and suitability of the model relative to the level of resolution desired and the level of effort (time, money, staff) available for the assessment, (2) the data available for developing the basic model, and (3) the data available for assessing the effects of a stress on the basic population processes. Simpler, less data-intensive models are useful for screening a large number of fish populations that may be at risk. Additional research can then be directed toward implementing more complex, data-intensive models for the reduced number of fish populations that are considered to be at risk. These modeling approaches should be used for making relative comparisons of stressed to unstressed fish populations rather than for attempting to attain the unrealistic goal of precisely predicting absolute population levels. (See also W87-07631) (Lantz-PTT)
W87-07648

MEASURING THE HEALTH OF AQUATIC ECOSYSTEMS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 2H.
W87-07649

STATE OF ECOSYSTEM MEDICINE,
Statistics Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 5G.
W87-07651

RESOURCE IMPACT EVALUATION OF IN-SITU URANIUM GROUNDWATER RESTORATION,
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 5G.
W87-07659

PRELIMINARY OBSERVATIONS ON USE OF ETHANOL DISTILLER'S BY-PRODUCTS FOR POLYCULTURE OF FRESHWATER PRAWN (MACROBRACHIUM ROSENBERGII) AND GOLDEN SHINER (NOTEMIGONUS CRYSOLEUCAS),
Southern Illinois Univ. at Carbondale. Fisheries Research Lab.
For primary bibliographic entry see Field 3C.
W87-07661

ANNUAL REPORT, 1984.
Interagency Task Force on Acid Precipitation, Washington, DC.
For primary bibliographic entry see Field 2B.
W87-07728

WASTES IN THE OCEAN, VOLUME 6: NEARSHORE WASTE DISPOSAL.
For primary bibliographic entry see Field 5E.
W87-07729

IMPACT OF WASTE DISPOSAL IN NEARSHORE ENVIRONMENTS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W87-07730

BIOAVAILABILITY AND EFFECTS OF HEAVY METALS IN MARINE DEPOSITS,
Marine Biological Association of the United Kingdom, Plymouth (England).
G. W. Bryan.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 41-79, 4 fig, 3 tab, 140 ref. U.K. Department of the Environment Contract DGR 480/51.

Descriptors: *Coastal waters, *Heavy metals, *Marine sediments, *Ocean dumping, *Water pollution effects, *Waste disposal, *Bioavailability, Environmental effects, Iron, Molluska, Lead, Cadmium, Mercury, Path of pollutants, Stress.

Sediments provide a source of bioavailable metals. Apart from the metal concentrations, factors governing the availability of sediment metals include the relative amounts of various metal-binding components, such as organic matter and oxides of Fe, and the redox potential of the sediment. One

method of assessing the influence of these factors is by comparing metal concentrations in a single species of organism from a large number of sites that differ in sediment metal concentrations and other properties. In the deposit-feeding bivalve Macoma balthica, concentrations of Cd seem to depend mainly on those of the overlying water, whereas concentrations of Pb relate to those of the sediments but tend to be lower when sediment Fe levels are higher. Conversely, for several other species, increasing organic-compound concentrations in the sediment appears to be the most important factor in reducing the bioavailability of Hg. Apart from the levels of available heavy metals, other factors controlling accumulation by organisms include feeding behavior and the presence of various processes for regulation and detoxification. At present, studies demonstrating the effects of sediment metals, including Hg, Cu, and Zn, are largely confined to observations on the disappearance of species and the development of metal-tolerant strains in heavily contaminated areas. The use of more sensitive methods of effects monitoring based on various physiological, biochemical, and pathological indices of environmental stress indicate that in some cases heavy metals in less contaminated areas also exert effects. (See also W87-07729) (Author's abstract)
W87-07731

GILL BLACKENING AND FOULING IN THE ROCK CRAB, CANCER IRRORATUS, AS AN INDICATOR OF COASTAL POLLUTION,
National Marine Fisheries Service, Oxford, MD. Oxford Lab.
T. K. Sawyer, E. J. Lewis, M. E. Galasso, J. J. Ziskowski, and A. L. Pacheco.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 113-129, 5 fig, 7 tab, 18 ref.

Descriptors: *Costal waters, *Water pollution effects, *Waste disposal, *Rock crabs, *Gills, *New Jersey, *Raritan Bay, *Sandy Hook, *New York Bight, *Gill blackening, Marine enviornment, Physiological ecology.

Twenty-six collections of rock crabs, Cancer irroratus, were made in the New York Bight apex during 1979-1981 to estimate the incidence of gill blackening and fouling microorganisms. Without taking molting behavior or seasonal variations into account, the overall incidence of blackened gill was 4% in crabs from the Sandy Hook-Lower Raritan Bay complex in New Jersey and 2% in crabs from the New York sewage dumpsite. Specimens examined during or shortly after periods of molting rarely showed the blackened condition. In contrast, blackening ranged up to 4% in intermolt crabs captured in the Sandy Hook and Raritan Bays and up to 7% in those captured in the New York Bight. Seasonal molting activity by adult C. irroratus had measurable effect on the incidence of blackened gills. A comparison of data obtained during 1979-1981 with data collected during 1973-1978 showed that the cumulative incidence of gill blackening (4%) in bay crabs had not changed. However, in oceanic crabs, gill blackening had decreased from a previous value of 6% to 2%. The low cumulative value of 2% obtained during 1979-1981 occured because approximately 50% of the crabs examined were captured shortly after molting. Visual observation of gill blackening and histopathological observation of fouling organisms (diatoms, ciliates, and amoebae) showed that the best estimates of gill condition were obtained during intermolt periods of growth. (See also W87-07729) (Author's abstract)
W87-07734

BIOLOGICAL EFFECTS OF DREDGED-MATERIAL DISPOSAL IN ALBERNI INLET,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
C. D. Levings, A. P. Anderson, and G. W. O'Connell.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 131-155, 9 fig, 2 tab, 31 ref.

Descriptors: *Water pollution effects, *Coastal waters, *Dredging, *Waste disposal, *Alberni Inlet, *British Columbia, Ocean dumping, Spatial distribution, Temporal distribution, Marine environment, Estuaries, Polychaetes, Mollusks, Biomass, Silt, Kjeldahl nitrogen, Shrimp, Marine sediments.

Spatial and temporal distribution of benthic communities was examined at a dredged-material dumpsite in Alberni Inlet. Surveys were conducted in November 1976 to map the spatial extent of the dumpsite. Sediments were coarser at the dumpsite than in the trough of the inlet, reflecting their origin at the estuary. Cluster analysis for invertebrate community data showed four provinces: central, wood deris, dumpsite, and dumpsite fringe. Cluster analysis of taxa data did not show a homogeneous group of organisms using the dumped material. The dumpsite province was dominated by opportunistic polychaetes, Capitella spp. and Schistomeringos spp., for which average values of 2 species per 0.1 sq m, 415 individuals. sq m, and 0.3 gm/sq m (dry wt) were found. Stations outside the dumpsite yielded average values of 18 species/0.1 sq m, 2923 individuals/sq m, and 4.4 g/sq m. The dumpsite fringe province was characterized by Schistomeringos spp., another polychaete, Trochochaeta multisetosa, and the ubiquitous bivalve Axinopsida serricata. To examine the temporal variability in benthic communities and recolonization at the dumpsite, a dumpsite and a control station near the center of the fjord were sampled with replicate grabs on 16 cruises from November 1977 to November 1978. Disposal of 90,000 cu m of dredged material occurred from 15 October 1977 to 24 February 1978. Applying a two-way analysis of variance of the data, temporal differences in number of species, number of individuals, biomass, percent silt, and dissolved oxygen (1 m from bottom), organic carbon, and Kjeldahl nitrogen concentrations were all significant ($p < 0.05$) when stations were compared. During the dumping season, Axiopsis spinulicauda, was one of the larger crustaceans conspicuously reduced in abundance at the dumpsite. The species occurred in 25% of the grabs for the control site compared to 6% at the dumpsite. During dumping, sediment carbon-to-nitrogen (C/N) ratios at the dumpsite were 56:1, but recovered by April 1978 to about 25:1, a ratio typical of the control station. (See also W87-07729) (Author's abstract)
W87-07735

ATTEMPTS TO ABBREVIATE TIME TO END-POINT IN FISH HEPATOCARCINOGENESIS ASSAYS,
Environmental Research Lab., Gulf Breeze, FL.
J. A. Couch, and L. A. Courtney.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as PB84-246297. Price codes A03 in paper copy and A01 in microfiche. Report No. EPA-600/D-84-229, September 1984. 40 p, 17 fig, 1 tab, 17 ref.

Descriptors: *Dakota Aquifer, *Water pollution effects, *Fish physiology, *Carcinogens, Sublethal effects, Nitrosodiethylamine, Tissue analysis, Chemical analysis.

Adult and juvenile Cyrpinodon variegatus were exposed to relatively high sub-lethal concentrations of the potent carcinogenic agent, N-nitrosodiethylamine (DEN). Fish were exposed for several weeks under static conditions to initial DEN concentrations of 55 mg/L, dropping to 30 mg/L at exposure's end. Fish were then transferred to clean flow-through water for holding, observation, and charcterization of lesion development. Progression of the hepatic effects of DEN is being followed by periodic samping for histochemistry, histology, and electron microscopy. The earliest damage in the liver was assessed and subsequent progression of lesions is being monitored. Results to date suggest that relatively early foci of altered cells may be identified with traditional morphologic criteria as early as eight weeks following onset of exposure to DEN. Histochemical and ultrastructural early indicators of transformation are under investigation and are described. (Author's abstract)
W87-07782

PATHOLOGY LINKED TO WATER USE (PATHOLOGIE LIEE A L'SUSAGE DE L'EAU),
Lille-2 Univ. (France).
H. Leclerc.
Aqua AQUAAA, No. 6, p 329-333, June 1986. 2 tab, 18 ref.

Descriptors: *Water pollution effects, *Water supply, *Pathogens, *Infectious diseases, *Chlorination, *Ozonization, *Organic micropollutants.

Study of pathogenic microorganisms in aquatic media is imperative because water is an essential link in the transmission of such infectious diseases of the digestive tract as viral hepatitis, cholera, typhus and dysentery. In all the countries where the level of hygiene is advanced or there is a network of water distribution, the major historical epidemics are beginning to disappear. Technical and industrial activities are major sources of microbic contamination. Metallurgical and power generating industries create zones of reheated air which is favorable to the growth of pathogenic amoeba. Some industries, especially closed circuit refrigeration, emit huge quantities of fog and aerosols which are breeding grounds of these microorganisms. The perpetual recycling of this reheated air generates a dangerous ecosystem. Evidence of contamination in the sea-foods which can cause typhus, viral hepatitis and cholera as well as indirectly in the meat products of pig, cows and fowl which can cause salmonella. The chemistry of water consumed has also been studied: levels of cadmium, magnesium, and sodium for their effects on cardio-vascular illnesses and concentration of nitrates and nitrites for their mutagenic activities. For a few chlorination pollutants the effects of chlorination and ozonation were carried out. (Ray-PTT)
W87-07787

UPTAKE, DISTRIBUTION AND RETENTION OF ZINEB AND ZIRAM IN RAINBOW TROUT (SALMO GAIRDNERI),
Ministry of Transport and Public Works, Lelystad (Netherlands). Lab. for Ecotoxicology.
For primary bibliographic entry see Field 5B.
W87-07806

BEHAVIORAL AND HISTOLOGICAL EFFECTS OF ACRYLAMIDE IN RAINBOW TROUT,
Medical Coll. of Wisconsin, Inc., Milwaukee. Dept. of Pharmacology and Toxicology.
D. W. Petersen, K. R. Cooper, M. A. Friedman, and J. J. Lech.
Toxicology and Applied Pharmacology TXAPA9, Vol. 87. No. 1, p 177-184, January 1987. 2 fig, 1 tab, 26 ref.

Descriptors: *Water pollution effects, *Acrylamide, *Toxicity, Wastewater treatment, Flocculation, Histology, Fish behavior, Trout, Organic compounds.

The use of polyacrylamide as a flocculant in wastewater treatment and as a chemical grouting agent may result in the exposure of humans as well as aquatic species to waterborne residual acrylamide monomer. Acrylamide has well-known neurotoxic effects in mammals. A histological and behavioral study was used to assess whether acrylamide produced neurotoxic effects in rainbow trout. Swimming performance of trout exposed to 0, 12.5 or 25 mg/liter acrylamide for 15 days was unaffected. Swimming performance of animals exposed to 50 mg/liter acrylamide for a similar time period was compromised by morbidity and mortality of the animals in this treatment group. The absence of dose-related histological lesions in central neurons, peripheral neurons or muscle suggested that the observed deficit in swimming performance was due to a generalized toxic response. Acrylamide produced dose-related lesions in the gill and liver of rainbow trout. (Author's abstract)
W87-07808

NONENTERIC INFECTIONS ACQUIRED THROUGH CONTACT WITH WATER,
Tel-Aviv Univ. (Israel). Dept. of Internal Medicine.
S. Pitlik, S. A. Berger, and D. Huminer.

Reviews of Infectious Diseases RINDDG, Vol. 9, No. 1, p 54-63, January-February 1987. 2 tab, 143 ref.

Descriptors: *Water pollution effects, *Human diseases, *Infection, Pathogens, Water pollution.

In recent years water has been recognized as an important vehicle for extraintestinal infection. A variety of pathogens are acquired through occupational, recreational, and even therapeutic contact with water. The nature of nonenteric waterborne disease is often determined by the ecology of aquatic pathogens. Such infections are basically of two types: (1) superficial, involving damaged or previously intact mucosae and skin; and (2) systemic, often serious infections that may occur in the setting of depressed immunity. A broad spectrum of aquatic organisms, including viruses, bacteria, algae, and parasites, may invade the host through such extraintestinal routes as the conjunctivae, respiratory mucosae, skin, and genitalia. (Authors' abstract)
W87-07809

TRIALKYLLEAD OCCURRENCE, BIOLOGICAL INTERACTIONS, AND POSSIBLE IMPACT ON FOREST DECLINE,
Max-Planck-Inst. fuer Medizinische Forschung, Heidelberg (Germany, F.R.). Abt. Physiologie.
H. Faulstich, C. Stournaras, and K. P. Endres.
Experientia EXPEAM, Vol. 43, No. 2, p 115-127, February 1987. 10 fig, 74 ref.

Descriptors: *Lead, *Air pollution effects, *Water pollution effects, *Acid rain, *Forest decline, *Path of pollutants, *Forests, Pollutants, *Trialkyllead compounds, Cytotoxicity, Trees, Plant physiology, Rainfall, Phytotoxicity, Toxicity, Toxins, Fog.

Biochemical studies and experiments with cells showed that trialkyllead (R3Pb(+)), a degradation product of tetraalkyllead (R4Pb) antiknock agents, is highly cytotoxic. Trialkyllead may occur in rain and fog in concentrations much higher than those reported so far. From these data it was proposed that trialkyllead may represent one of the factors responsible for the present forest decline. The chemistry of trialkyllead was reviewed including its molecular interactions, its toxic effects on cells and on plant cells in particular, and its occurrence in the environment. Evidence for and against the involvement of trialkyllead in forest decline was discussed and it was concluded that, since many essential biological processes in mammalian and plant cells are specifically inhibited by trialkyllead, trees are also likely to be affected. A strong correlation was demonstrated between the occurrence of trialkyllead and acid rain, though it is not yet known whether acid rain influences the uptake or biological activities of trialkyllead. (Wood-PTT)
W87-07820

IODINATION OF NUTRIENTS IN THE PRESENCE OF CHLORINE BASED DISINFECTANTS USED IN DRINKING WATER TREATMENT,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W87-07834

INFLUENCE OF WATER HARDNESS, PH, AND ALKALINITY ON THE MECHANISMS OF COPPER TOXICITY IN JUVENILE RAINBOW TROUT, SALMO GAIRDNERI,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
D. J. Lauren, and D. G. McDonald.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1488-1496, August 1986. 4 fig, 3 tab, 36 ref.

Descriptors: *Hardness, *Hydrogen ion concentration, *Alkalinity, *Copper, *Toxicity, *Trout, *Water pollution effects, *Path of pollutants, Fish, Heavy metals, Acidity, Chemical properties, Sodium, Bioaccumulation, Accumulation, Mortality.

Juvenile rainbow trout were exposed to 25-400 micrograms copper/l for 24 hours. Water hardness, pH, and alkalinity were varied independently at a constant sodium concentration. Net and unidirectional sodium fluxes were measured in hard and soft low-alkalinity water and in hard high-alkalinity water at neutral pH and at pH 5.0. In low-alkalinity water, Na(+) uptake was inhibited at copper concentrations as low as 25 micrograms/l, and sodium efflux was stimulated about 100 micrograms/l. High-alkalinity water significantly reduced the effects of copper on uptake and efflux, but there was no significant effect of increasing water hardness. The effects of pH 5.0 and copper were additive from 25 to 100 micrograms/l, but a pure copper effect was found from 200 to 400 micrograms/l. Fish died when they had lost about 50-55% of their exchangeable Na(+) pool. Water hardness and alkalinity had no effect on the apparent uptake of copper, but copper uptake was reduced by about 50% at pH 5.0. (Author's abstract)
W87-07879

EFFECTS OF PH ON THE TOXICITIES OF CADMIUM, COPPER, AND ZINC TO STEELHEAD TROUT (SALMO GAIRDNERI),
Western Washington Univ., Bellingham. Inst. for Watershed Studies.
R. F. Cusimano, D. F. Brakke, and G. A. Chapman.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1497-1503, August 1986. 2 fig, 5 tab. 27 ref.

Descriptors: *Hydrogen ion concentration, *Toxicity, *Cadmium, *Copper, *Zinc, *Trout, *Hardness, *Water pollution effects, Acidity, Chemical properties, Heavy metals, Bioaccumulation, Accumulation, Snowmelt, Fish, Chelation, Fish physiology, Animal physiology.

Since increased metal concentrations have been associated with freshwater acidification, continuous-flow acute toxicity tests were conducted in soft water to determine the effect of pH on the toxicity of cadmium, copper, and zinc to small (1-6 g) steelhead trout (Salmo gairdneri). LC50 values were calculated for 96- and 168-h exposure periods in waters of pH 4.7, 5.7, and 7.0. Test fish were significantly more tolerant of the metals at the lowest pH value than at higher pH values. The 96-h LC50 values at pH 4.7, 5.7, and 7.0 were 671, 97, and 66 micrograms/l for zinc, 66.0, 4.2, and 2.8 micrograms/l for copper, and 28.0, 0.7, and < 0.5 micrograms/l for cadmium, respectively. The 168-h results were similar to the 96-h values. These results indicate that for the metals tested, toxicity is ameliorated in depressed pH waters over short exposure periods, such as may occur during snowmelt runoff. The possibility of hydrogen ion interference with metal uptake is postulated. (Author's abstract)
W87-07880

LOCOMOTOR ACTIVITY AND BLOOD PLASMA PARAMETERS OF ACID-EXPOSED LAKE WHITEFISH, COREGONUS CLUPEAFORMIS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
E. Scherer, S. E. Harrison, and S. B. Brown.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1556-1561, August 1986. 1 fig, 2 tab, 59 ref.

Descriptors: *Fish behavior, *Acid rain, *Blood, *Bioindicators, *Whitefish, *Acidic water, *Water pollution effects, Fish, Acidity, Sodium, *Chlorides, Hydrogen ion concentration, Glucose, Environment, Aquatic environment, Lakes.

Changes in level and diel pattern of spontaneous locomotor activity of lake whitefish exposed to acidified waters were investigated in the laboratory, along with concomitant changes in blood plasma parameters. Lake whitefish (Coregonus clupeaformis) were exposed to acidified water of pH 5.0, 4.7, 4.4, and 4.1 for two wks; controls were held at pH 7.6. Continuous recordings of locomotor activity over four days and nights at the end of each treatment showed a consistent trend towards reduced daytime activity and loss of diel rhythmicity with increasing ambient acidity. Feeding was observed to decrease at pH 4.7, and to cease at pH 4.4 and 4.1. Associated with these behavioral effects were changes of blood plasma variables. Plasma cortisol and glucose levels increased with lowered pH; sodium, chloride, and their fractional contribution to osmolality decreased. (Author's abstract)
W87-07883

SUSCEPTIBILITY OF BROOK TROUT (SALVELINUS FONTINALIS) FRY TO A LIQUID FORMULATION OF BACILLUS THURINGIENSIS SEROVAR. ISRAELENSIS (TEKNAR (R)) USED FOR BLACKFLY CONTROL,
Quebec Univ., Trois-Rivieres. Groupe de Recherche sur les Insectes.
C. Fortin, D. Lapointe, and G. Charpentier.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1667-1670, August 1986. 1 fig, 21 ref. FCAR Grant 83-EQ-2098 and C.R.S.A.Q. Grant UQTR-83-1039.

Descriptors: *Trout, *Biocontrol, *Insect control, *Blackflies, *Pesticide toxicity, *Insecticides, *Xylene, *Bacillus, *Water pollution effects, Pesticides, Toxicity, Mortality, Fish, Chromatography, Gas chromatography, Suspended solids, Bacteria, Insects, Aquatic insects.

The susceptibility of brook trout (Salvelinus fontinalis) fry to Teknar (R) under acute exposure was studied in a commercial fish hatchery in Quebec. Teknar is an 8% water-based formulation of a Bacillus thuringiensis delta-endotoxin designed for blackfly and mosquito control. Exposure of trout fry to 4,500 and 6,000 mg Teknar/l for 45 min resulted in 20 and 86.4% mortality, respectively. At concentrations of 3,000 mg/l and higher, fish became motionless and exhibited variable recovery within 2 h following contact, depending on concentration. Fish exposed to 6,000 mg freeze-dried Teknar/l were not affected. Forty-eight hours of static exposure resulted in 1.33% mortality at 60 mg/l, no mortality at 300 mg/l, and 8% mortality for the controls; degradation of water quality may explain this response. Gas chromatographic analysis revealed the presence of 2% xylene in the formulation. Fish fed with chow contaminated with 30% (w/w) Teknar did not show any response. Considering the recovery and the absence of effects in 48-h static tests, the feeding test, and exposure to the freeze-dried formulation, it is concluded that the observed response is due to the effect of xylene used as a preservative agent in the formulation. (Author's abstract)
W87-07888

GENERAL MULTIVARIATE DOSE - RESPONSE MODEL,
Department of Fisheries and Oceans, Nanaimo (British Columbia). Pacific Biological Station.
J. Schnute, and J. O. T. Jensen.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1684-1693, September 1986. 3 fig, 11 ref, 2 append.

Descriptors: *Dose-response models, *Toxicity, *Statistical models, *Water pollution effects, *Multivariate analysis, *Model studies, Prediction, Mathematical studies, Mathematical equations, Fish, Statistical analysis.

A general model is presented for describing and predicting biological response to environmental factors. The theory embraces concepts and models used in earlier studies of the effects of toxicity on fish, and it extends these ideas in several directions. It can include an arbitrary number of factors, either detrimental or beneficial to the organism. Also, its statistical formulation allows both hypothesis testing to determine the relative importance of various factors and calculation of critical factor levels that (with prescribed confidence) assure a community response no worse than a specified level. The model is based on earlier work by Schnute and McKinnell, and its parameters have biologically meaningful interpretations. A discussion is presented, including an explanation of how the model relates specifically to toxicity studies. In

a companion paper, the model is used to investigate salmonid response to gas supersaturation and ancillary factors. (See also W87-07890) (Author's abstract)
W87-07889

ASSESSING JUVENILE SALMONID RESPONSE TO GAS SUPERSATURATION USING A GENERAL MULTIVARIATE DOSE - RESPONSE MODEL,
Department of Fisheries and Oceans, Nanaimo (British Columbia). Pacific Biological Station.
J. O. T. Jensen, J. Schnute, and D. F. Alderdice.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 9, p 1694-1709, September 1986. 9 fig, 9 tab, 33 ref.

Descriptors: Derscriptors: *Toxicity, *Salmon, *Gas pressure, *Supersaturation, Dose response meodels, *Statistical models, *Multivariate analysis, *Model studies, *Water pollution effects, Fish, Mathematical studies, Mathematical models, Mathematical equations, Statistical analysis, Prediction, Mortality, Oxygen, Dissolved oxygen, Nitrogen, Temperature, Water temperature, Water depth, Graphical methods.

The effects of excess total gas pressure (TGP%) on juvenile salmonids (chinook, coho, sockeye, and steelhead) are investigated based on data compiled from the literature. The study relates exposure time to 50% mortality (ET50) to TGP%, component levels of dissolved oxygen (O2%) and nitrogen (N2%), water depth, temperature, barometric pressure (BP), and fish size. A new device called a tabular histogram is employed for exploratory data analysis. Statistical hypotheses are formulated and tested by applying the general multivariate dose-response model described in a companion paper. When modeled in response to TGP%, ET50 follows a typical exponential dose-response relationship. Based on the full data set, two ancillary factors, water depth and fish length, significantly improve the model's ability to explain variations in ET50. Furthermore, based on a smaller subset of the data, either of the factors O2% or N2% also improves the model fit significantly. For 50-d exposures, apparently 'safe' levels of TGP% range from 103.8 to 114.8%, depending on associated factor levels of water depth and fish size. (See also W87-07899) (Author's abstract)
W87-07890

EFFECTS OF A SHORT-TERM EXPERIMENTAL ACIDIFICATION ON A MICROINVERTEBRATE COMMUNITY: RHIZOPODA, TESTACEA,
Quebec Univ., Montreal. Dept. of Biological Sciences.
G. Costan, and D. Planas.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 6, p 1224-1230, June 1986. 4 fig, 3 tab, 52 ref.

Descriptors: *Acid rain, *Limnology, *Acidic water, *Water pollution effects, *Protozoa, *Population density, *Species diversity, *Lotic environment, *Ecological effects, Aquatic animals, Density, Environment, Sulfuric acid, Nitric acid, Water pollution, Invertebrates, Physicochemical properties, Water properties, Physical properties, Chemical properties, Ecology, Acid streams, Rainfall, Potassium.

The effects of short-term acidification on the density and diversity of testate amoebae were investigated in seminatural conditions using an experimental setup simulating a lotic ecosystem. Decreases in density were observed during sulfuric acid and nitric acid treatments (highly significant differences in the acidified channels compared with the nonacidified control channel); the major impact occurred at the 12-h acidification point. Diversity fluctuated with regard to variations in its two components, evenness and number of species. The response was qualitatively different (specific richness) but quantitatively nonsignificant (density) depending on the type of acid used. It is suggested that the osmotic regulatory mechanisms of the amebae are considerably perturbed by acid shock and associated chemical modifications such as a marked increase in potassium released from sediments. The possible alteration of the food resource during acidification may also contribute to the decrease in density. A slight (nonsignificant) population recovery at the 24-h acidification point is due to subdominant species, suggesting that these may be more tolerant of new habitat conditions. (Author's abstract)
W87-07897

EFFECTS OF DIETARY ALUMINUM SULPHATE ON REPRODUCTIVE SUCCESS AND GROWTH OF RINGED TURTLE-DOVES (STREPTOPELIA RISORIA),
National Wildlife Research Centre, Ottawa (Ontario).
D. Carriere, K. L. Fischer, D. B. Peakall, and P. Anghern.
Canadian Journal of Zoology CJZOAG, Vol. 64, No. 7, p 1500-1505, July 1986. 4 tab, 38 ref.

Descriptors: *Acid rain, *Aluminum sulfate, *Growth, *Reproduction, *Turtle-doves, *Animal physiology, *Water pollution effects, *Birds, Toxicity, Aquatic insects, Diets, Calcium, Phosphorus, Eggs, Fertility, Magnesium, Aluminum, Accumulation, Bioaccumulation.

Elevated levels of aluminum have been reported in surface waters and in certain aquatic organisms including insects. Toxic effects have been demonstrated in fish, and it has been suggested that aluminum affects avian reproduction. In this study, ringed turtle-doves were assigned to a control group fed a diet reduced in calcium and phosphorus and to a treated group fed the same diet supplemented with 0.1% aluminum. A four-month feeding period with aluminum sulfate did not affect egg production, fertility, or hatchability. Egg permeability was decreased initially but subsequently recovered to a normal level. Dietary aluminum sulfate did not affect plasma calcium, phosphorus, or magnesium of adults, nor did it affect the growth pattern or the final weight of chicks feeding on the same diet. Bone aluminum levels of breeding females averaged twice those of the controls. The pattern of accumulation between the two sexes was significantly different. Growth of juvenile ringed turtle-doves was not affected by dietary levels of aluminum sulfate up to 1500 ppm, although aluminum tended to accumulate in the sternum. No significant influence of aluminum was found on reproduction or growth at levels similar to those likely to occur in the environment. (Author's abstract)
W87-07902

EFFECT OF PETROLEUM HYDROCARBONS ON THE BILIARY BILE ACID COMPOSITION OF RAINBOW TROUT (SALMO GAIRDNERI),
Department of Fisheries and Oceans, St. John's (Newfoundland). Fisheries Research Branch.
J. Hellou, and J. F. Payne.
Comparative Biochemistry and Physiology (C), Vol. 84, No. 2, p 257-261, 1986. 3 fig, 7 tab, 33 ref.

Descriptors: *Hydrocarbons, *Trout, *Water pollution effects, *Fish physiology, *Bile acids, *Toxicity, Oil, Chromatography, Thin layer chromatography, Gas chromatography, Organic acids, Acids, Enzymes.

Biliary bile acid profiles were investigated by thin layer and gas liquid chromatography in fish exposed to a Venezuelan crude petroleum or a triglyceride-rich oil (olive oil). Neither volume of bile nor bile acid pools were affected, compared to controls, in fish fed either petroleum or olive oil. The response was not uniform, but a small increase in the ratio of the primary bile acids, cholic to chenodeoxycholic, was observed in a number of fish exposed to petroleum. Petroleum appeared not to simply mimic a fatty food source in altering the cholic to chenodeoxycholic acid ratio. Results do not support the hypothesis that the elevation of mixed function oxygenase enzymes by such potent inducers as petroleum hydrocarbons could markedly alter bile acid profiles, or result in the production of novel bile acid metabolites. (Author's abstract)
W87-07919

XENOBIOTIC METABOLIZING ENZYMES IN SPAWNING ENGLISH SOLE (PAROPHRYS VETULUS) EXPOSED TO ORGANIC-SOLVENT EXTRACTS OF MARINE SEDIMENTS FROM CONTAMINATED AND REFERENCE AREAS,
National Marine Fisheries Service, Seattle, WA. Biochemical Effects Task.
T. K. Collier, J. E. Stein, R. J. Wallace, and U. Varanasi.
Comparative Biochemistry and Physiology (C), Vol. 84, No. 2, p 291-298, 1986. 2 fig, 4 tab, 44 ref.

Descriptors: *English sole, *Reproduction, *Metabolism, *Enzymes, *Hydrocarbons, *Aromatic hydrocarbons, *Chlorinated hydrocarbons, *Spawning, *Fish physiology, *Marine sediments, *Water pollution effects, Sediments, Fish, Contamination, Water pollution, Liver, Toxicity, Benthic fauna, Aquatic animals, Benthos, Fauna.

Female English sole (Parophrys vetulus) within 1-2 days of spawning were exposed to organic solvent extracts of contaminated marine sediments from two sites in Puget Sound, WA. Extracts from Eagle Harbor contained aromatic hydrocarbons (AH) at doses of 6.8 mg/kg body weight; extracts from Duwamish Waterway contained AH at 0.52 mg/kg and chlorinated hydrocarbons at 0.040 mg/kg. Control fish were exposed to extracts from Hood Canal (0.00090 mg AH/kg). Hepatic aryl hydrocarbon hydroxylase (AHH) activity, measured at spawning, was induced 10-, 23-, and 2-fold by Eagle Harbor, Duwamish, and Hood Canal extracts, respectively, compared to sham and vehicle controls. Hepatic glutathione-S-transferase and epoxide hydrolase activities were not affected by any treatment. Eagle Harbor extracts (but not other treatments) inhibited spawning in 36% of exposed fish, and AHH activity in the non-spawning fish was significantly higher than in the fish that did spawn. These results suggest a potential for reproductive toxicity in benthic fish after exposure to sediment-associated contaminants. (Author's abstract)
W87-07920

CHANGES OF PHOSPHORUS AND NITROGEN CONCENTRATION AND OF PHYTOPLANKTON IN ENRICHED LAKE ENCLOSURES,
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
For primary bibliographic entry see Field 2H.
W87-07951

EXAMINATION OF THE GENERALITY OF EUTROPHICATION MODELS,
Royal Danish School of Pharmacy, Copenhagen.
S. E. Jorgensen, L. Kamp-Nielsen, and L. A. Jorgensen.
Ecological Modelling ECMODT, Vol. 32, No. 4, p 251-266, July 1986. 6 fig, 6 tab, 21 ref.

Descriptors: *Limnology, *Model testing, *Eutrophication, *Case studies, *Model studies, *Lakes, *Aquatic ecosystems, *Nutrients, Trophic level, Shallow water, Deep water, Climatic zones, Temperate zone, Tropic zone, Ecosystems, Mass transfer, Prediction, Species composition, Phytoplankton, Plankton, Aquatic plants, Seasonal variation, Algae, Biomass, Zooplankton, Fish, Precipitation, Sediments, Detritus, Calibration.

A eutrophication model of medium complexity was applied to 16 case studies covering shallow and deep lakes and firths under temperate and tropical climatic conditions. Provided that the basic model is modified in accordance with the characteristic features of the considered ecosystem and adjusted for essential nutrient mass flows, deviations between observations and model output were found to be reasonable and estimated ranges for almost all parameters are in accordance with literature values. In two case studies, it was possible to validate a model prediction under radically changed nutrient loadings. However, a model which is able to account for a shift in species composition might be better able to predict the maximum phytoplankton concentration and the date of spring and summer maxima in algal biomass. (Author's abstract)

W87-07968

PERSISTENT BLOOM OF THE DIATOM RHIZOSOLENIA ERIENSIS (SMITH) AND OTHER CHANGES ASSOCIATED WITH DECREASES IN HEAVY METAL CONTAMINATION IN AN OLIGOTROPHIC LAKE, VANCOUVER ISLAND,
Ministry of Environment, Nanaimo (British Columbia). Waste Management Branch.
J. Deniseger, A. Austin, M. Roch, and M. J. R. Clark.
Environmental and Experimental Botany EEBODM, Vol. 26, No. 3, p 217-226, July 1986. 6 fig, 3 tab, 30 ref.

Descriptors: *Diatoms, *Rhizosolenia, *Eutrophication, *Limnology, *Heavy metals, *Water pollution effects, *Mine wastes, *Contamination, *Oligotrophic lakes, *Vancouver Island, Copper, Lead, Zinc, Lakes, Water pollution, Phytoplankton, Plankton, Aquatic plants, Nutrients, Density, Population density, Industrial wastes, Accumulation, Bioaccumulation, Food habits, Chrysophyta, Algae.

Qualitative and quantitative samples of phytoplankton were obtained, along with limnological data, at specific stations in Buttle Lake (Vancouver Island, British Columbia); this long, narrow, oligotrophic lake has been receiving heavy metal pollution from a copper-lead-zinc mine since 1967. Although metal concentrations in the lake have steadily decreased since peaking in 1980-81, a single species of diatom, Rhizosolenia eriensis, now dominates the phytoplankton community to the virtual absence of other species. Changes in nutrient patterns may have given R. eriensis a competitive advantage over other species. R. eriensis occurs in quantities up to 11,000 cells/ml, and the cell accumulates zinc up to 56,000 times and copper 34,000 times water concentrations. It is concluded that the dominance of R. eriensis may have contributed to the continuing decline in zooplankton numbers through unpalatability. These data illustrate that the recovery process in perturbed systems is not merely a reversal of trends to a pre-disturbance state; despite apparent improvement in heavy metal concentrations in Buttle Lake, water quality may be deteriorating as a result of dominance of R. eriensis and the lack of zooplankton. (Doria-PTT)
W87-07979

ACETYLENE REDUCTION RATE AS A PHYSIOLOGICAL INDICATOR OF THE RESPONSE OF FIELD-GROWN SOYBEANS TO SIMULATED ACID RAIN AND AMBIENT GASEOUS POLLUTANTS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
R. J. Norby, B. K. Takemoto, J. W. Johnston, and D. S. Shriner.
Environmental and Experimental Botany, Vol. 26, No. 3, p 285-290, July 1986. 1 fig, 1 tab, 17 ref. EPRI Contract 1908-2, DOE Contract DE-AC05-840R21400.

Descriptors: *Acetylene reduction, *Indicators, *Soybeans, *Acid rain, *Bioindicators, *Air pollution effects, *Stress, *Enzymes, *Simulated rainfall, Rainfall, Air pollution, Vegetation effects, Plant physiology, Assays, Chemistry of precipitation, Statistical analysis, Filtration, Acidity, Chemical properties, Precipitation.

The usefulness of nitrogenase activity as a physiological indicator of whole-plant response to environmental stresses such as gaseous air pollutants or acidic rain was evaluated. The acetylene reduction rate of excised nodules of field-grown soybean plants was assayed during a two-year experiment in which the soybeans were exposed in open-top field chambers to simulated rain of pH 3.2, 4.2, or 5.2 in combination with nonfiltered (polluted) or charcoal-filtered air. There was no evidence of an effect of rain chemistry on nitrogenase activity. There was also no statistically significant effect of air filtration on the acetylene reduction rates, although rates were consistently lower in the nonfiltered chambers than in the charcoal-filtered chambers. The large experimental variance, which was partly attributable to sampling constraints, and the evidence for biological compensatory responses suggest that nitrogenase activity may not be a sensitive physiological indicator of stresses induced by acid rain or gaseous pollutants in soybeans. (Author's abstract)
W87-07980

TOXICITY OF 2,4-DICHLOROPHENOXYACETIC ACID TO THE ADULT CRESTED NEWT,
Milan Univ. (Italy). Ist. di Biologia.
N. P. Zaffaroni, T. Zavanella, A. Cattaneo, and E. Arias.
Environmental Research ENVRAL, Vol. 41, No. 1, p 79-87, October 1986. 2 fig, 2 tab, 43 ref.

Descriptors: *Toxicity, *Phenoxyacetic acid pesticides, *Population expsoure, *Newts, *Water pollution effects, Pesticides, Herbicides, Amphibians, Mortality, Liver, Kidney, Histology, Water pollution.

The percutaneous toxicity of the herbicide Agroxone 5, a commercial formulation of the iso-octyl ester of 2,4-D, was tested in the adult crested newt. The compound was lethal to all the animals within 72 hr at concentrations of 100, 125, and 150 ppm. Males appeared to be more susceptible than females, since the LT50 values at 75 ppm were 102 and 132 hr for male and female newts, respectively. At 50 ppm, all the males died within 31 days of exposure, whereas the females were still alive at the end of the three-month experiment. Only one male died at 25 ppm after 21 days. Vacuolar degeneration of liver parenchyma and necrosis of kidney tubules were found at lethal concentrations of 2,4-D. The severity of the lesions was related to the duration of exposure more than to the concentration of the herbicide. (See also W87-07988) (Author's abstract)
W87-07986

ASBESTOS FIBERS AND TRACE METALS IN THE BLOOD OF CATTLE GRAZING IN FIELDS INUNDATED BY ASBESTOS-RICH SEDIMENTS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W87-07987

TOXICITY OF 2-METHYL-4-CHLOROPHENOXYACETIC ACID TO THE ADULT CRESTED NEWT,
Milan Univ. (Italy). Ist. di Biologia.
N. P. Zaffaroni, T. Zavanella, M. L. Ferrari, and E. Arias.
Environmental Research ENVRAL, Vol. 41, No. 1, p 201-206, October 1986. 1 fig, 1 tab, 37 ref.

Descriptors: *Pesticide toxicity, *Phenoxyacetic acid pesticides, *Newts, *Water pollution effects, Pesticides, Herbicides, Amphibians, Mortality, Morbidity, Histology, Water pollution, Liver, Kidney, Muscle.

The toxicity of the herbicide Agroxone 3, a commercial formulation of the sodium salt of 2-methyl-4-chlorophenoxyacetic acid (MCPA) was tested in the adult newt. At the concentration of 3,200 ppm, the LT50 values were 17 and 21 hr for male and female newts. At 1,600 ppm, the LT50 values were 35 and 45.5 hr. At 800 ppm, most of the animals were still alive after three months. There were no deaths at 400 and 200 ppm. Severe neuromuscular disorders were observed in animals exposed to lethal concentrations. (See also W87-07986) (Author's abstract)
W87-07988

EFFECT OF COPPER AND CADMIUM ON CARBON ASSIMILATION AND UPTAKE OF METALS BY ALGAE,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-08003

EFFECTS OF LOW PH ON REPRODUCTION OF RAINBOW TROUT,
Oregon Cooperative Fishery Research Unit, Corvallis.
G. S. Weiner, C. B. Schreck, and H. W. Li.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 1, p 75-82, January 1986. 2 tab, 39 ref. EPA Interagency agreement AD-14F2A100.

Descriptors: *Acid rain, *Hatching, *Fish eggs, *Water pollution effects, *Trout, *Reproduction, *Fish physiology, *Acidic water, *Acid streams, *Toxicity, Fish, Hydrogen ion concentration, Acidity, Chemical properties, Survival, Eggs, Tissue analysis, Blood, Calcium, Sodium, Ecological effects, Streams.

Reproduction of rainbow trout was studied in acidic water. Adults were exposed to waters of pH 4.5, 5.0, or 5.5 during the final 6 weeks of reproductive maturation; control acidities were pH 6.5-7.1. Progeny of acid-exposed females and control males had reduced survival through 7 d of development, hatching, and yolk-sac absorption, demonstrating that oogenesis is sensitive to acidic conditions. Similar reductions in the survival of the progeny of acid-exposed males and control females indicated the sensitivity of spermatogenesis to low ambient pH. Among the progeny of unexposed adults, survival through 7 d of development and hatching was lower during rearing at pH 4.5, 5.0, or 5.5 than at pH 6.5-7.1. No eggs exposed to pH 4.5 survived to the eyed stage. Concentrations of plasma estradiol, androgens, and a dihydroprogesterone in acid-exposed adult rainbow trout revealed no gross physiological abnormalities. Plasma calcium concentrations in adult females were unaffected by low pH, but were decreased in adult males exposed to pH 4.5 for 42 d. Plasma sodium concentrations fell slightly in adult fish after 7 d of exposure to pH 4.5, 5.0, or 5.5, and continued to decline in fish exposed to pH 4.5. It is concluded that reproduction of rainbow trout may be affected by environmental acidification below pH 5.5. (Author's abstract)
W87-08043

ACUTE TOXICITY TESTS ON THE FRESHWATER ISOPOD, ASELLUS AQUATICUS USING FESO4.7H20, WITH SPECIAL REFERENCE TO TECHNIQUES AND THE POSSIBILITY OF INTRASPECIFIC VARIATION,
Sheffield Univ. (England). Dept. of Zoology.
L. Maltby, J. O. H. Snart, and P. Calow.
Environmental Pollution, Vol. 43, No. 4, p 271-279, April 1987. 1 fig, 6 tab, 18 ref. EEC Stimulation action grant STP-0086-1-UK(CD).

Descriptors: *Mine drainage, *Bioassay, *Bioindicators, *Toxicity, *Water pollution effects, *Iron sulfate, *Isopods, *Effluents, Mine wastes, Asellus, Buffers, Tolerance, Iron compounds, Pollutants, Population exposure.

Techniques are described for assessing the toxicity of Fe(II), an important component of the effluent from mines, to the freshwater isopod, Asellus aquaticus. These techniques either involve buffer systems or working at low pH. Both techniques indicate that A. aquaticus is very tolerant of Fe(II). Furthermore, the low-pH technique suggests that animals from sites exposed to mine-waste pollution are more tolerant than those from sites not so exposed. This difference is masked in the buffer experiments, possibly due to the formation of less toxic buffer-Fe(II) complexes. (Author's abstract)
W87-08056

ASSESSMENT OF THE CHRONIC TOXICITY OF THE SYNTHETIC PYRETHROID, FENVALERATE, TO DAPHNIA GALEATA MENDOTAE, USING LIFE TABLES,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
K. Day, and N. K. Kaushik.
Environmental Pollution, Vol. 44, No. 1, p 13-26, 1987. 3 fig, 2 tab, 32 ref.

Descriptors: *Water pollution effects, *Fenvalerate, *Daphnia, *Toxicity, *Population exposure,

*Life history studies, *Insecticides, Pyrethroids, Pesticides, Cladocera, Survival, Reproduction.

The effects of chronic exposure to fenvalerate, a synthetic pyrethroid insecticide, on the cladoceran Daphnia galeata mendotae were evaluated under laboratory conditions. The daphnids were exposed for their entire life cycle to concentrations ranging from 0.005 to 0.1 microgram(ug) fenvalerate/L. The parameters used to determine toxicity were survival, time to first reproduction, reproductive frequency, number of young per brood, cumulative brood size, intrinsic rate of natural increase (r sub m), generation time (T) and net reproductive rate (R sub O). A concentration of 0.005 ug fenvalerate/L resulted in an increase in longevity but a decrease in production of young. Higher concentrations caused a decrease in survival. Studies of shorter duration than the complete life cycle of the organisms would not have detected toxicity at such low levels. The intrinsic rate of natural increase, r sub m, was not affected by fenvalerate until concentrations reached 0.05 ug/L and r sub m decreased to 0.113 from 0.238. A concentration of 0.01 ug/L caused the net reproductive rate, R sub O, and the generation time, T, to decrease to 73.2 offspring per female and 17.3 days from 125.9 offspring per female and 20.3 days, respectively. (Author's abstract)
W87-08107

TEST OF FLUCTUATING ASYMMETRY IN BLUEGILLS (LEPOMIS MACROCHIRUS RAFINESQUE) AS A MEASURE OF PH-RELATED STRESS,
National Fisheries Contaminant Research Center, Columbia, MO.
For primary bibliographic entry see Field 2H.
W87-08108

EFFECTS OF SAWDUST POLLUTION ON THE GERMINATION OF FUNGAL SPORES IN LAGOS LAGOON,
Lagos Univ. (Nigeria). Dept. of Biological Sciences.
T. V. I. Akpata.
Environmental Pollution, Vol. 44, No. 1, p 37-48, 1987. 7 tab, 19 ref.

Descriptors: *Wood wastes, *Limnology, *Water pollution effects, *Germination, *Fungal spores, *Lagos Lagoon, Inhibition, Isolation, Extraction, Nutrients, Carbon, Nitrogen, Salinity, Salts, Coastal waters.

Four fungi, Aspergillus flavus, Aspergillus giganteus, Cladosporium oxysportum and Trichoderma aureoviride, isolated from Lagos Lagoon, were tested for spore germination in aqueous sawdust extract of different hardwood species (Khaya ivorensis, Mitragyna ciliata and Triplochiton scleroxylon). Extracts of M. ciliata were inhibitory to spore germination especially at higher concentrations. Germ tubes of spores decreased in length with increase in extract concentration for C. oxysporum and T. aureobiride, while Aspergillus species showed increase in length up to a peak at 3% sawdust extract concentration, and thereafter germ tube lengths decreased with increasing concentration. Extracts of T. scleroxylon stimulated the spores and percentage germination increased at higher extract concentrations with no significant difference in germ tube length. Similarly, K. ivorensis had a stimulatory effect on spore germination and length of germ tube, especially at higher extract concentrations. Addition of soluble exogenous carbon and nitrogen sources to sawdust extract enhanced spore germination. Apart from A. flavus, which had only 9% germination, all the spores failed to germinate in lagoon water having 2.1% salinity. The spores were also inhibited by various inorganic salts, i.e. CaCl2, KH2PO4, MgSO4 and NaCl, present in Lagos Lagoon. The results suggest that sawdust pollution causes enrichment of the lagoon, thereby enhancing spore germination. (Author's abstract)
W87-08109

EFFECTS OF LONG-TERM EXPOSURE TO CYTHION ON THE REPRODUCTION OF THE TELEOST FISH, CHANNA PUNCTATUS (BLOCH),
R. N. Ram, and A. G. Sathyanesan.
Environmental Pollution, Vol. 44, No. 1, p 49-60, 1987. 9 fig, 1 tab, 33 ref.

Descriptors: *Population exposure, *Toxicity, *Cythion, *Water pollution effects, *Fish reproduction, *Channa, *Teleosts, *Pesticides, *Organophosphorus compounds, Fish physiology, Spawning, Gonads, Oocytes, Biochemistry.

The chronic toxic effects of an organophosphorus pesticide on some aspects of the physiology of reproduction in a teleost fish, Channa punctatus, are described in this investigation. Fish exposed to 2.0 mg/liter of commercial cythion continuously for 6 months, from January (resting phase) to June (spawning phase), exhibited a significant inhibition of gonadal development and gonadosomatic index. These changes were correlated with less active, and a reduced number of pituitary gonadotrophs, and biochemical changes in the gonads and liver. The immature oocytes of the experimental fish exhibited cytoplasmic proteinaceous 'inclusion bodies', which ultimately led to their degeneration. The results suggest that cythion may act directly on the gonads and/or through the pituitary-gonadal axis, in this species. (Author's abstract)
W87-08110

EFFECT OF AMBIENT OZONE POLLUTION AND ACIDIC RAIN ON THE GROWTH AND CHLOROPHYLL CONTENT OF GREEN AND WHITE ASH,
New Jersey Agricultural Experiment Station, New Brunswick.
C. L. Elliott, J. C. Eberhardt, and E. G. Brennan.
Environmental Pollution, Vol. 44, No. 1, p 61-70, 1987. 1 fig, 7 tab, 17 ref. NJAES Project 11353.

Descriptors: *Acid rain, *Tree growth, *Acid rain effects, *Ozone pollution, *Ash trees, *Water pollution effects, *Air pollution effects, *Chlorophyll, Population exposure, Seedlings, New Jersey, Toxicity, Rainfall, Shoots, Plant growth.

Two- and three-year old green ash (Fraxinus americana L.) and white ash (Fraxinus pennsylvanica Marsh.) seedlings were exposed to combinations of ambient ozone and acidic ambient rainfall in New Brunswick, New Jersey. During the 3-year study the potted seedlings did not develop typical foliar ozone toxicity symptoms, despite the occurrence of as many as 78 h in exceedance of the National Ambient Air Quality Standard of 0.12 ppm. Although the pH of the rainfall was as low as 3.6 and averaged 4.1, no symptoms were observed resulting from the ambient precipitation. The rate of shoot growth in terms of height and diameter was generally not affected by either of the pollutants during the growing season. Although the chlorophyll content of white ash foliage was low following frequent rainfall in the early summer of 1984, there was no statistically significant evidence that acid raid or ambient ozone decreased chlorophyll in ash seedlings during the 3-year study. (Author's abstract)
W87-08111

EFFECT OF FERTILIZER ON THE GROWTH OF RADISH PLANTS EXPOSED TO SIMULATED ACIDIC RAIN CONTAINING DIFFERENT SULFATE TO NITRATE RATIOS,
Boyce Thompson Inst. for Plant Research, Ithaca, NY.
J. S. Jacobson, J. J. Troiano, L. I. Heller, and L. Osmeloski.
Environmental Pollution, Vol. 44, No. 1, p 71-79, 1987. 2 tab, 21 ref.

Descriptors: *Fertilizers, *Acid rain effects, *Radishes, *Plant growth, *Acid rain, *Simulated acid rain, *Sulfates, *Nitrates, *Water pollution effects, Acid rain, Population exposure, Biomass, Shoots, Nutrients.

Two successive experiments were performed in the greenhouse to test the hypothesis that plant response to the amounts and ratios of sulfuric and nitric acids in rain is affected by the amount of fertilizer added to the growing medium. Radish plants, grown with different levels of N-P-K fertilizer, were given ten 1-h exposures over a 3-week period to simulate acidic rain at pH values from 2.6 to 5.0 and sulfate to nitrate mass ratios from 0.3 to 7.5. Increased acidity of simulated rain reduced plant growth, with a greater depression of hypocotyl mass than shoot mass. The reverse growth response occurred with increased supply of fertilizer: plant biomass rose with a larger increase in shoot mass than hypocotyl mass. In one experiment, plants that received a greater supply of fertilizer exhibited more obvious reductions in growth of shoots at the higher levels of acidity of simulated rain. There were no significant effects of sulfate to nitrate ratios in simulated rain on plant growth, nor any effect of this ratio on the response of shoots and hypocotyls to acidity of simulated rain. Addition of fertilizer had no effect on plant response to sulfate to nitrate ratios. These results do not support the hypothesis that nutrient-deficient plants are either more or less responsive to sulfate and nitrate in rain than plants grown with optimal supplies of nutrients. They support previous results indicating no effects of sulfate to nitrate ratio in simulated acidic rain on plant growth. The results also suggest that the greatest risk of harmful effects on vegetation may come from the combination of high sulfate and high acidity in rainfall. (Author's abstract)
W87-08112

COMMUNITY HOSPITAL OUTBREAK OF LEGIONELLOSIS: TRANSMISSION BY POTABLE HOT WATER,
New York State Dept. of Health, Albany.
J. P. Hanrahan, D. L. Morse, V. B. Scharf, J. G. Debbie, and G. P. Schmid.
American Journal of Epidemiology AJEPAS, Vol. 125, No. 4, p 639-649, April 1987. 2 fig, 2 tab, 28 ref.

Descriptors: *Water pollution effects, *Pollutant identification, *Legionellosis, *Potable water, *Public health, *Community hospitals, *Epidemiology, Risk factors, Disease transmission, Isolation, Pneumonia, Showers, Hot water, Aerosols.

Seven cases of nosocomial legionellosis occurred between February and September 1982 in a small community hospital in Upstate New York. All seven were cases of Legionella pneumophila serogroup 1; six were hospital patients and one a hospital employee. None of the cases died. During the peak of the outbreak, the incidence of nosocomial legionellosis was 1.2 cases per 100 patient discharges. An epidemiologic comparison of the six patient cases with 21 matched patient controls suggested that longer hospital stay (chi sub 1 squared = 24.2, $p < 0.001$) and the proximity of patients' rooms to ward showers (chi sub 1 squared = 4.4, $p < 0.04$) were significant risk factors for acquiring legionellosis. An environmental investigation demonstrated that the ward showers and the hospital hot water system were contaminated with L. pneumophila serogroup 1. Monoclonal antibody subtyping performed on isolates obtained during the outbreak investigation confirmed that the hot water system and patient isolates had an identical pattern of reactivity. The outbreak demonstrates that legionellosis can be a significant cause of nosocomial pneumonia in a community hospital and that transmission can occur from contaminated potable hot water sources, potentially via shower aerosols. (Author's abstract)
W87-08136

HEALTH ASPECTS OF GROUNDWATER RECHARGE,
Los Angeles County Sanitation Districts, Whittier, CA.
For primary bibliographic entry see Field 4B.
W87-08148

SOIL DEPOSITION OF TRACE METALS DURING GROUNDWATER RECHARGE USING SURFACE SPREADING,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.

For primary bibliographic entry see Field 2F.
W87-08158

ENVIRONMENT AND SOLID WASTES: CHARACTERIZATION, TREATMENT, AND DISPOSAL,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5D.
W87-08166

CEGB EXPERIENCE IN FUEL ASH DISPOSAL,
Central Electricity Generating Board, Nottingham (England). Midlands Region.
For primary bibliographic entry see Field 5E.
W87-08170

CORRELATIONS OF PHYSICAL AND CHEMICAL PROPERTIES OF COMPOUNDS WITH THEIR TOXICITIES AND DISTRIBUTIONS IN THE ENVIRONMENT,
Dow Chemical Co., Midland, MI. Dept. Health and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W87-08175

ASSESSING THE EFFECTS OF CONTAMINANTS ON THE STRUCTURE AND FUNCTION OF AQUATIC ECOSYSTEMS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. M. Giddings.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 245-258, 1 fig, 20 ref. DOE Contract W-7405-eng-26.

Descriptors: *Ecological effects, *Water pollution effects, *Ecosystems, Environmental impact statement, Organic compounds, Inorganic compounds, Bioassays.

Ecosystems are the context in which all organisms live, reproduce, interact, and evolve. A balanced approach to environmental impact assessment includes consideration of effects on whole ecosystems as well as analyses of effects on organisms and populations. Potential effects of contaminants on whole ecosystems include changes in energy flow, nutrient flow, or trophic structure. Such changes are generally not predictable from measurements of responses of individual species, but must be determined by investigating whole ecosystems. Responses of aquatic ecosystems to organic and inorganic contaminants have been demonstrated in microcosms (laboratory models of ecosystems) simulating various aquatic environments. Examined here is the range of potential interactions between chemical pollutants and aquatic ecosystems. The focal point of the discussion is the ecosystem, rather than any particular group of aquatic organisms. The methods go beyond the acute bioassay to a more complete and realistic style of environmental assessment. (See also W87-08166) (Lantz-PTT)
W87-08182

RISK ANALYSIS: SOLID WASTES FROM OIL SHALE AS AN EXAMPLE OF THE USE OF HEALTH EFFECTS AND ECOLOGICAL DATA FOR RISK ESTIMATION,
IWG Corp., San Diego, CA.
L. B. Gratt.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 285-298, 1 fig, 3 tab, 9 ref. DOE Contract EV 10706.

Descriptors: *Solid wastes, *Risk assessment, *Oil shale, *Ecological effects, *Waste disposal, Industrial wastes, Water pollution effects.

Risk analysis is a predictive process that provides information to aid in formulating and managing a program of environmental research. Health risks are determined by an interactive process that uses: (1) exposure resulting from source terms, as characterized by the probability of exposure to pollutants and accidents, based on a reference industry fuel cycle; (2) health effects, as characterized by the conditional probability of effect given the exposure; and (3) the population at risk. The health risk is defined as the expectation of the population health effects for all exposures under consideration. The oil shale industry will be an immense solids-handling industry moving 1,900,000 t of raw shale to produce 1,000,000 bbl/d of oil. Solid waste generated by the oil shale industry will increase air and water pollution. Air pollutants from solid waste piles are primarily fugitive dust. Water pollutants derived from solid wastes consist of leachates percolated from spent shale. Health effects, both public and occupational, for oil shale can be analyzed for both threshold and nonthreshold effects. Airborne pollutants, especially dust and particulates, are a major concerns for the occupational workforce. The potential for serious water pollution exists, especially from leachates from the spent shale. Ecosystem risks result from the loss of habitat associated with the enormous amount of solid waste generated by a commercial-size oil shale industry. Crude models for indicator species using available data indicate that the mule deer population may decline by one-fifth, and trout populations in the region may be drastically curtailed under extreme conditions. (See also W87-08166) (Author's abstract)
W87-08185

METROPOLITAN WASTEWATER MANAGEMENT COMMISSION SLUDGE MANAGEMENT PLAN, EUGENE-SPRINGFIELD, OREGON.
Environmental Protection Agency, Seattle, WA. Region X.
For primary bibliographic entry see Field 5D.
W87-08216

EFFECTS OF ACID RAIN ON PLANT MICROBIAL ASSOCIATIONS IN CALIFORNIA,
California Univ., Berkeley. Dept. of Plant and Soil Biology.
D. Harris, and E. A. Paul.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-242122. Price codes: A04 in paper copy, A01 in microfiche. Report to the California Air Resources Board, April 13, 1984. 66 p, 7 fig, 25 tab, 23 ref. Project No. A2 087-32.

Descriptors: *Water pollution effects, *Acid rain effects, *California, *Isotope studies, *Simulated rainfall, Simulation analysis, Hydrogen ion concentration, Trifoliums, Lupinus, Microbiological studies.

The effects of simulated acid rain of pH 5.6 to 3.0, with ionic composition similar to that found in California, on Trifolium repens, Lupinus densiflorus and L. benthamii grown in two soils were tested. The interactions of treatment intensity, soil type, phosphorus uptake and mycorrhizal influences on growth, carbon fixation and allocation and nitrogen fixation were determined. Acidic treatments generally decreased plant growth, nodulation and nitrogenase activity. The exposure of plants to a large number of simulated rainfall conditions of shorter duration did not result in the negative growth effects. Plants adequately supplied with P, either as fertilizer or by mycorrhizal fungi, were much more resistant to conditions caused by acidic precipitation and in some cases growth increases were found. Measurements of carbon incorporation rates, beneath ground respiration and carbon allocation in established plants (10 to 12 weeks) was conducted in a specially designed growth chamber which allowed exposure of above ground plant parts to carefully controlled levels of 14-CO2. Beneath ground respiration could then be measured separately. These measurements showed only a 25% decrease due to the observed acid rain treatment and did not account for the 2-3 fold differences in plant yield. This was attributable at least in part to a decrease in sensitivity to the acid rain treatments in the older plants used for the 14-C studies. Internal turnover rates of carbon under acidic conditions were very high but the effect of this on long-term growth has not been clearly delineated. Lupines and clovers were found to be acid sensitive associations that occur widely in California rangelands on soils that vary in acid sensitivity. This work has shown that further field studies of the physiological processes involved in growth and plant nutrition should lead to much better criteria regarding acidic inputs into natural environments. (Author's abstract)
W87-08217

METHODS TO EVALUATE ECOTOXICOLOGICAL EFFECTS OF CHEMICALS (METHODEN ZUR OKOTOXIKOLOGISCHEN BEWERTUNG VON CHEMIKALIEN),
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projekttraeger fuer Umweltchemikalien.
F. Fuhr, H. M. Biehl, and W. Thielert.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-03045. Price codes: A06 in paper copy, A01 in microfiche. Band 2: Boden und Modellsysteme Arbeitsgemeinschaft 'Boden und Chemikalien' Bericht 1979-1983. Report No. Juel-Spez--224, October 1983. 107 p, 30 fig, 39 tab, 20 ref.

Descriptors: *Toxicology, *Ecological effects, *Germany, *Water pollution effects, Adsorption, Chemical analysis, Cadmium, Mercury, Chromium, Selenium, Herbicides, Heavy metals, Polychlorinated biphenyls.

The Minister of Science and Technology of the Federal Republic of Germany supports research in the field of 'methods to evaluate ecotoxicological effects of chemicals'. In the ecosystem, the soil is the major sink for environmental chemicals. In a coordinated program, several laboratories have conducted research to evaluate and standardize different methods to study degradation, accumulation and effects of chemicals in the soil. Results from a four year study are presented in five reports on adsorption/desorption, translocation and degradation of chemicals in 15 soils of the Federal Republic of Germany. Partial laboratory results are compared with data achieved in field studies. The following test chemicals have been included in the program: Cd-, Hg-, Cr-, and Se-compounds, the herbicides 2,4,5-T, and pichloram, the tenside LAS, PCB as well as halogenorganic compounds. On the basis of the results, standardized test methods are proposed. (Author's abstract)
W87-08232

FISH HEAD ACETYLCHOLINESTERASE ACTIVITY AFTER AERIAL APPLICATION OF TEMEPHOS IN TWO RIVERS IN BURKINA FASO, WEST AFRICA,
Institute of Aquatic Biology, Achimota (Ghana).
L. A. K. Antwi.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 461-466, March 1987.

Descriptors: *Pesticides, *Larvicides, *Phosphorothioate pesticides, *Water pollution effects, *Temephos, *Rivers, *Fish physiology, Parasites, Environmental effects, Ecological effects, Fish, Tilapia, Stream fisheries, Disease control.

A 20 year program to control onchocerciasis in the Volta River Basin in West Africa began in 1974. An organophosphorus larvicide, temephos (0,0,0',0'-tetramethyl 0,0'-thiodi-p-phenylene phosphorothioate) is applied aerially on a weekly basis to all breeding sites of Simulium damnosum in the rivers of the program area. The environment is monitored to assess the effects of larvicide application on non-target organisms. Many of the treated rivers flow into man-made lakes of major economic importance, and all treated rivers support an economically important fish industry. This study examines the effect of 6 years application of temephos on the acetylcholinesterase (AChE) activity per whole head of 4 commercial fish species (Tilapia galilaea, Tilapia nilotica, Alestes nurse, and Schilbe mystus) from 2 treated rivers in the Ouaga-

dougou area of Burkina Faso. In all four fish species examined there was no statistically significant difference in total AChE activity per whole head of fish between the treated rivers and the control sites. It is suggested that fish avoid the larvicide during application periods by swimming downstream or into untreated tributaries. In addition to this avoidance reaction, the non-persistent nature of temephos and the volume of flowing river water may contribute to the results. (McFarlane-PTT)
W87-08259

MAMMALIAN MITOCHONDRIA AS IN VITRO MONITORS OF WATER QUALITY,
Wisconsin Univ.-Madison. Water Resources Center.
For primary bibliographic entry see Field 5A.
W87-08260

COMBINED TOXICITY OF FOUR TOXICANTS (CU, CR, OIL, OIL DISPERSANT) TO ARTEMIA SALINA,
Athens Univ. (Greece). Zoological Lab. and Museum.
G. Verriopoulos, M. Moraitou-Apostolopoulou, and E. Milliou.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 483-490, March 1987. 3 fig, 3 tab, 11 ref.

Descriptors: *Toxicity, *Synergistic effects, *Water pollution effects, *Trace metals, *Copper, *Chromium, Oil, Dispersants, Hazardous substances, Pollution, Coastal waters, Heavy metals.

This study estimates the joint toxicity of some pollutants commonly found in nearshore polluted waters; two metals (copper and chromium), an oil (Tunesian crude oil zarzaitine type), and an oil dispersant (Finasol OSR-2). The test animals were Artemia salina. Acting individually, copper was more toxic (LC50 = 0.485 ppm) than chromium (LC50 = 12.838 ppm), and oil (LC50 = 297.8 ppm) was far less toxic than the oil dispersant (LC50 = 0.90 ppm). Acting in mixtures of two, toxicity was either additive (Cr + oil, Cr + dispersant) or less than additive (Cu + Cr and oil + dispersant). Acting jointly in mixtures of three, all were less than additive. All four pollutants mixed together gave a less than additive reaction. (McFarlane-PTT)
W87-08262

ARSENIC TOXICITY CHANGES IN THE PRESENCE OF SEDIMENT,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Sciences.
G. A. Burton, J. M. Lazorchak, W. T. Waller, and G. R. Lanza.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 491-499, March 1987. 5 fig, 3 tab, 16 ref.

Descriptors: *Arsenates, *Arsenites, *Analytical methods, *Pesticides, *Herbicides, *Arsenic, *Sediment, *Toxicity, *Daphnia, Pesticide toxicity, Enzymes, Survival, Population exposure, Crustaceans.

The widespread use of arsenic as a herbicide has resulted in high soil and sediment concentrations in some areas. Arsenite is more toxic than arsenate to Daphnia magna, while arsenate depresses phosphatase activity to a greater degree than arsenite. This study reports on the effect of sediments on standard arsenite LC50 determinations with Daphnia and alkaline phosphatase activity (APA). Turbidity in the test vessels was not a major negative in survival but may have had an important positive effect in reducing water arsenic concentrations. Oxidation of arsenite to less toxic arsenate species may have contributed to decreasing toxicity. Survival in vessels without sediment changed very little over time as arsenic apparently remained in the water column and continued to exert toxic effects on the Daphnia. Using sediment in the LC50 test better represents in situ conditions than traditional tests with water only. Natural aquatic systems contain varying degrees of suspended solids and also contain sediment, therefore daphnids are in the presence of suspended solids and sediment when exposed to toxicants. The presence of sediments significantly increases Daphnia survival through time when initially exposed to arsenite. (McFarlane-PTT)
W87-08263

METABOLIC CONSEQUENCES OF METHYL PARATHION EXPOSURE IN THE BIVALVE, LAMELLIDENS MARGINALIS (LAMARCK),
Sri Venkateswara Univ., Tirupati (India). Dept. of Zoology.
P. K. Mohan, L. V. Reddy, C. R. Shankara, and K. Indira.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 509-514, March 1987. 1 tab, 15 ref.

Descriptors: *Water pollution effects *Bioaccumulation, *Metabolism, *Bioindicators, *Parathion, Mollusks, Pesticides, Organic pesticides, Enzymes, Tissue analysis.

Fresh water mussels tolerate high levels of pesticide toxicity. This study traces the metabolic consequences of methyl parathion exposure in foot, mantle and adductor muscle tissue with reference to ammonia detoxification mechanisms. Lactic acid levels increased to maximum extent in the foot (25%) as compared to mantle (14%) and adductor muscle (9%). The foot also demonstrated elevated levels of ammonia due to increased purine catabolism. AMP deaminase showed differential activity, increasing by 52, 45, and 35 percent in foot, mantle, and adductor muscle, respectively. Glutamate dehydrogenase activity increased in all tissues exposed to methyl parathion. This freshwater bivalve appears to have inherent tissue specific resistance potentiality to withstand ambient pesticide toxicity by modifying its metabolism. (McFarlane-PTT)
W87-08264

SENSITIVITY OF TOAD TADPOLES, BUFO MELANOSTICTUS (SCHNEIDER), TO HEAVY METALS,
Industrial Toxicology Research Centre, Lucknow (India).
B. S. Khangarot, and P. K. Ray.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 523-527, March 1987. 2 tab, 19 ref.

Descriptors: *Toxicity, *Tadpoles, *Toads, *Water pollution effects, *Heavy metals, Trace elements, Trace metals, Cadmium, Copper, Chromium, Mercury, Nickel, Silver, Zinc.

This study determined the acute toxicity of cadmium, copper, chromium, mercury, nickel, silver and zinc to tadpoles of the toad, Bufo melanostictus, which is commonly available and breeds in aquatic habitats exhibiting a wide range of temperature and varying water quality. The 96 h LC50 values indicated a decreasing rank order of toxicity is Ag, Hg, Cu, Cd, Zn, Ni, and Cr. The toxicity of silver was more than 12,000 times that of chromium. (McFarlane-PTT)
W87-08266

ESTIMATING THE HEALTH RISKS OF RADON IN DRINKING WATER,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
C. R. Cothern.
Journal of the American Water Works Association JAWWA5, Vol. 79, No. 4, p 153-158, April 1987. 5 fig, 6 tab, 22 ref.

Descriptors: *Water quality, *Public health, *Radon, *Drinking water, *Water pollution effects, *Lung cancer, Water supply, Water treatment, Inhalation, Risks, Estimating, Aeration, Activated carbon.

By combining information about the occurrence, transport, exposure, and health effects of radon in drinking water, it has been estimated that over a period of 70 years (the average lifetime in the United States), between 2000 and 40000 lung cancer fatalities are caused by inhalation of natural radon released from US public water supplies. The average concentration of radon in these water supplies generates a lifetime risk of about 1 in 10000, the highest level of risk allowed for any contaminant currently regulated under the Safe Drinking Water Act. Reducing the levels of radon in drinking water, which would significantly lessen the risks to health, has been found to be feasible by either aeration or treatment with granular activated carbon. (Author's abstract)
W87-08308

POTENTIAL TOXICITY OF URANIUM IN WATER,
Utah Univ., Salt Lake City. Radiobiology Div.
M. E. Wrenn, P. W. Durbin, D. L. Willis, and N. P. Singh.
Journal of the American Water Works Association JAWWA5, Vol. 79, No. 4, p 177-184, April 1987. 3 fig, 4 tab, 57 ref. DOE Contract DE-AC02-76EV-00119 and EPA CR812681-01-03.

Descriptors: *Model studies, *Bioaccumulation, *Water pollution effects, *Toxicity, *Uranium, *Radium isotopes, Public health, Radiation effects, Epidemiology, Organs.

The nephrotoxic responses of mammalian species, including humans, to injected, inhaled, ingested, and topically applied uranium compounds have been thoroughly investigated. Because there appear to be no unequivocal reports of uranium-induced radiation effects in humans, it is necessary to rely on experimental work with animals and on epidemiological investigations of human populations exposed to radium isotopes to infer human response to the alpha-particle emissions of uranium. Metabolic models have been developed to relate the intake of uranium in water and food to its uptake in the human skeleton and soft tissues, of which the kidney is the critical organ. A US Environmental Protection Agency committee has recommended a limit for uranium in drinking water of 100 microgram/L, which includes a substantial safety factor, to limit effects on the kidney. (Author's abstract)
W87-08312

NUTRIENT ENRICHMENT AND EUTROPHICATION OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
C. L. Schelske.
Available from the National Technical Information Service, Springfield, VA 22161, as DE82-015576. Price codes A02 in paper copy and A01 in microfiche. DOE/EV/02003--44, April 1982. Department of Energy, Washington, DC. 23 p. DOE Contract No. DE-AC02-76EV02003.

Descriptors: *Water pollution effects, *Eutrophication, *Phosphorus, *Nutrients, *Phytoplankton, *Algae, *Lakes, Lake Michigan, Silica, Diatoms, Trophic level, Algal growth, Cyanophyta.

The final report on a 1969-1981 study of eutrophication in Lake Michigan summarizes accomplishments and significance of research. It lists 44 reports written during the project, approximately 50 papers presented at meetings, and 7 papers in progress. Nutrient enrichment experiments showed that phosphorus was the limiting nutrient for phytoplankton. Thus phosphorus addition accelerated phytoplankton growth and eutrophication. The imbalance in the inputs of phosphorus and silica caused a decrease in silica concentrations which limited diatom production and increased production of blue-green algae. (Cassar-PTT)
W87-08360

PROCEEDINGS OF A SEMINAR ON ATTAINING WATER QUALITY GOALS THROUGH WATER MANAGEMENT PROCEDURES.
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 5G.
W87-08365

HAZARD ASSESSMENT OF CHEMICALS: CURRENT DEVELOPMENTS, VOLUME 1.
For primary bibliographic entry see Field 5A.
W87-08394

REPRODUCTIVE TOXICOLOGY OF AQUATIC CONTAMINANTS,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
W. J. Birge, J. A. Black, and B. A. Ramey.
IN: Hazard Assessment of Chemicals: Current Developments, Vol. 1, Academic Press, New York. 1981. p 59-115, 7 fig, 7 tab, 196 ref. Contract No. AEN 74-00768 A01.

Descriptors: *Fish eggs, *Larvae, *Water pollution effects, *Fish toxins, *Amphibians, Organic compounds, Polychlorinated biphenyls, Heavy metals, Metals, Pesticides, Phenols, Industrial wastes, Toxicity, Inorganic compounds.

Since reproduction is a sensitive target of aquatic contaminants, increased emphasis has been placed on the use of chronic life-cycle and embryo-larval toxicity tests for establishing water quality criteria for hazardous materials. Embryo-larval test procedures may be of the static renewal type or of the continuous flow type and may be used for hazard assessment or to determine the effects of pollution stress on population dynamics. Some inorganic toxicants that affects the reproduction of aquatic organisms are B, Cd, Cu, Hg, Ni, and other metals. They occur in the aquatic environment usually from agricultural, mining, or industrial sources and affect the eggs and larvae of various species of fish. Organic toxicants which inhibit animal reproduction include polychlorinated biphenyls, pesticides, phenolic compounds, and chloroform. Phenolic compounds and many other industrial chemicals (e.g. chlorobenzene, carbon tetrachloride, chloroform, methylene chloride) are also highly toxic to developmental stages of fish and amphibians. Much of the additional literature on the reproductive toxicology of organic compounds is summarized. Of the great number of organic compounds which may potentially contribute to freshwater pollution, very few have been studied for toxic effects on reproduction. (See also W87-08394) (Geiger-PTT)
W87-08397

DIRECT AND INDIRECT EFFECTS OF ACIDIC DEPOSITION ON VEGETATION, ACID PRECIPITATION SERIES, VOLUME 5.
Butterworth Publishers, Boston. 1984. 117 p. Volume edited by Rick A. Linhurst. Series edited by John I. Teasley.

Descriptors: *Water pollution effects, *Acid rain, *Vegetation, *Forests, Ecosystems, Precipitation, Trees, Soil chemistry, Growth rates, Plant diseases.

The complexity of studying effects of acid rain precipitation on vegetation, particularly forests, is emphasized. In fact, indirect effects may ultimately prove to be more significant than direct effects such as tissue lesions. A holistic approach will produce the most understanding of the effects of acid deposition. Chapters include discussions on the ecosystem level and on individual plants. Some of the interactions considered are the indirect effects of acid rain on plant diseases, insects, and microorganisms. On the forest community level, chapters concern chemical responses of forest canopies to acid rain and changes in forest tree growth rates in New England. The forest site index is suggested as a methodology for defining the forest resources at risk from long-term inputs of acid precipitation. (See also W87-08402 thru W87-08408) (Cassar-PTT)
W87-08401

ECOSYSTEMS APPROACH TO THE ACID RAIN PROBLEM,
Vermont Univ., Burlington. Dept. of Botany.
R. M. Klein.
IN: Acid Precipitation Series, Volume 5: Direct and Indirect Effects of Acidic Deposition on Vegetation, Butterworth Publishers, Boston. 1984. p 33-50, 2 fig, 3 tab, 68 ref.

Descriptors: *Water pollution effects, *Acid rain, *Ecosystems, *Vegetation, Model studies, Trees, Forests, Camels Hump Mountain, Vermont, Mountains, Red spruce, Trees, Litter, Nutrients, Precipitation.

A conceptual ecosystem model was developed to study the effects of acid rain. Most of the field data was collected at Camels Hump Mountain in the Green Mountains of Vermont. Between 1965 and 1979 several changes in the basal area and density of dominant tree species were noted. Red spruce declined significantly during this period. The average pH of rain is 4.0, and this precipitation contains heavy metals. Mycorrhiza were not found on roots of red spruce from the boreal zone but were found on roots in the hardwood zone. The area of forest floor covered by mosses was reduced by about 50%. Between 1965 and 1982 the depth of litter increased by a factor of 2. The high acidity was believed to depress microbial decomposition. Most of the studies described in this paper are not yet complete, and definite conclusions have not been made. (See also W87-08401) (Cassar-PTT)
W87-08402

EFFECTS OF ACID PRECIPITATION ON PLANT DISEASES,
North Carolina State Univ. at Raleigh. Dept. of Plant Pathology.
R. I. Bruck, and S. R. Shafer.
IN: Acid Precipitation Series, Volume 5: Direct and Indirect Effects of Acidic Deposition on Vegetation, Butterworth Publishers, Boston. 1984. p 19-32, 3 fig, 51 ref.

Descriptors: *Water pollution effects, *Acid rain, *Vegetation, *Plant diseases, Diseases, Pathogens, Parasites, Soil chemistry, Fungi, Roots.

Most plant diseases consist of delicate interactions between higher plants and microorganisms. Acidic precipitation represents an environmental stress that has been shown to affect expected development of some diseases and similar phenomena under experimental conditions. From the perspective of the disease triangle framework, this impact may be expressed through increased plant susceptibility (through physical wounding or impaired physiological activity), decreased plant susceptibility through altered metabolic pathways, decreased pathogen activity (from intolerance to low-pH conditions by vegetative or survival structures or from increased activity of competitors) or increased pathogenicity (by stimulation from more favorable pH conditions for acidophilic organisms or by elimination of competitors). Aerial plant parts are directly exposed to rainfall, and the potential influence of acidic precipitation on pathogens and diseases of aboveground tissues seems obvious. However, soilborne pathogens and root diseases may also be significantly altered by short-term acidification of the soil solution resulting from acid deposition or by gradual changes in bulk soil chemical characteristics over a long period of time. Although research in this area is only beginning, knowledge of the biological, ecological and economic impacts of diseases of agricultural crops and native vegetation suggests that acidic precipitation plays a significant role in the subtle interactions of plants and their parasites. (See also W87-08401) (Author's abstract)
W87-08403

EFFECTS OF ACIDIC DEPOSITION ON FOREST VEGETATION: INTERACTION WITH INSECT AND MICROBIAL AGENTS OF STRESS,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
W. H. Smith, G. Geballe, and J. Fuhrer.
IN: Acid Precipitation Series, Volume 5: Direct and Indirect Effects of Acidic Deposition on Vegetation, Butterworth Publishers, Boston. 1984. p 33-50, 2 fig, 3 tab, 68 ref.

Descriptors: *Water pollution effects, *Acid rain, *Vegetation, *Forests, Insects, Microorganisms, Stress, Trees, Pathogens, Plant diseases, Diseases, Soil chemistry.

A review of the evidence on the interaction of forest trees, insects and microbial pests, and acid deposition does not allow generalized statements concerning stimulation or restriction of biotic stress agents or their activities by acid deposition. The modest evidence available is from laboratory and controlled environment studies. There is no evidence on this topic from studies employing large trees under field conditions. We have presented several testable hypotheses for potential mechanisms of interaction between host plants, biotic stress factors and acid deposition. In the instance of leaf- or bark-infesting or -feeding insect species, or foliar or stem pathogens, the potential for significant interaction with acid deposition is particularly high as these pest organisms spend important segments of their life cycles on the surfaces of plants. Phytophagous soil arthropods and root-infecting microorganisms are less likely to be influenced by acid deposition than are surface organisms. Soil organism influence would only follow acid deposition induced alteration in soil pH or chemistry or altered host resistance. The potential for biotic stress agent interaction is judged to be higher in forest ecosystems than in agricultural ecosystems not receiving intensive pesticide applications, as pest management would overwhelm and generally preclude meaningful acid deposition-biotic stress interaction. The threshold range of ambient pH above which little adverse influence on insect or microbial pest activity is anticipated is pH 3.5-4.0. (See also W87-08401) (Author's abstract)
W87-08404

MICROBIAL RESPONSE TO ACID DEPOSITION AND EFFECTS ON PLANT PRODUCTIVITY,
California Univ., Berkeley. Dept. of Plant and Soil Biology.
M. K. Firestone, J. G. McColl, K. S. Killham, and P. D. Brooks.
IN: Acid Precipitation Series, Volume 5: Direct and Indirect Effects of Acidic Deposition on Vegetation, Butterworth Publishers, Boston. 1984. p 51-63, 2 fig, 4 tab, 16 ref. Contract No. A8-136-31.

Descriptors: *Water pollution effects, *Acid rain, *Vegetation, *Microorganisms, Precipitation, Rhizosphere, Soil Chemistry, Nitrification, Aluminum, Metals, Roots, Toxicity.

There were no observable effects on the microbial activities tested of the acidified precipitation (pH 4.0) that was most similar to that of real acid rain. However, the short durations of the treatments (3 months) precludes statement of direct conclusions concerning effects of long-term, ambient acid deposition. Substantially intensified acid inputs (pH 2 and in some cases pH 3) did not affect microbial activity. The total H+ load from three months of pH 2 precipitation would be the same as that from 30 months of pH 3 or 300 months of pH4. However, the effects that result from pH 2 precipitation cannot be extrapolated to predict long-term effects of more realistic acidified precipitation because the interactions of acidity with the soil physical and microbial components have an extremely important time dependence. Mineral solubilization reactions (involved in buffering), microbial adaptation and reequilibration of organic matter pools are slow processes. Effects which result from accelerated treatments may never occur with less rapid rates of H+ input. But the possibility that changes in microbial activity will result from long-term, moderate pH inputs makes continued investigation, using longer exposure periods, essential. (See also W87-08401) (Author's abstract)
W87-08405

BIOGEOCHEMICAL RESPONSES OF FOREST CANOPIES TO ACID PRECIPITATION,
Maine Univ. at Orono. Land and Water Resources Center.
C. S. Cronan.
IN: Acid Precipitation Series, Volume 5: Direct and Indirect Effects of Acidic Deposition on Vegetation, Butterworth Publishers, Boston. 1984. p. 65-79, 4 fig, 5 tab, 24 ref. Contract Nos. EV04498 and EV10750.

Descriptors: *Water pollution effects, *Acid rain, *Vegetation, *Forests, Canopy, Throughfall, Coniferous forests, Hardwood, Trees, Neutralization, Mt. Moosilauke, White Mountains, New Hampshire, Leaching, Ion exchange.

The responses of two New England forest systems, high-elevation coniferous and lower-elevation hardwood, to acid precipitation were compared in a study of canopy throughfall. In both forest systems canopy throughfall was markedly enriched in ionic concentration, apparently a result of neutral salt leaching or washout. Direct precipitation was not significantly neutralized in transit through the balsam fir canopy. The net effect was acidification of the precipitation by canopy uptake of ammonium with H+ release and washing off of acids accumulated on the foliage. The hardwood forest canopy noticeably neutralized acid precipitation, especially during leaf senescence. Canopy neutralization of acid deposition occurred through two mechanisms: washout or leaching of weak Bronsted bases from foliar surfaces or leaf surface ion exchange removal of H+ ions. Although the throughfall concentrations in high-elevation coniferous forests were lower than in hardwood forests, the coniferous system processed larger amounts of total precipitation and showed net throughfall element fluxes similar to fluxes in the lower-elevation hardwood forests. (See also W87-08401) (Cassar-PTT)
W87-08406

ASSESSING THE POSSIBILITY OF A LINK BETWEEN ACID PRECIPITATION AND DECREASED GROWTH RATES OF TREES IN THE NORTHEASTERN UNITED STATES,
Pennsylvania Univ., Philadelphia. Dept. of Geology.
A. H. Johnson, T. G. Siccama, R. S. Turner, and D. G. Lord.
IN: Acid Precipitation Series, Volume 5: Direct and Indirect Effects of Acidic Deposition on Vegetation, Butterworth Publishers, Boston. 1984. p 81-95, 9 fig, 6 tab, 24 ref.

Descriptors: *Water pollution effects, *Acid rain, *Vegetation, *Forests, *Growth rates, Spruce trees, Red spruce trees, Coniferous forests, New Jersey Pinelands, Camels Hump Mountain, Green Mountains, Vermont, Aluminum, Sulfur, Nitrogen, Potassium.

Tree rings were studied in the New Jersey Pinelands and Green Mountains, Vermont, in an attempt to correlate growth abnormalities with the increase in acid precipitation starting in the 1950s. In the period 1963-1979 the stream pH and tree radial growth rate in the Pinelands Decreased in a similar pattern. Comparison with tree ring records dating to 1852 indicated that no other recorded event such as drought caused a long-lasting change in growth. However, white pine, which is sensitive to sulfur dioxide, showed no noticeable decline in growth rate. In the Green Mountain study soil pH at Camels Hump Mountain did not change between 1965 to 1980. Neither did root condition in red spruce change significantly. Thus, no compelling evidence was obtained to show the connection of the red spruce decline with soil chemistry. Compared with a control site, foliage at the Camels Hump site showed differences in composition: less K, more S and Al. At Camels Hump foliage increased in N and S with elevation; K decreased with elevation. Foliage from trees in good condition had lower S levels and higher S:N levels than trees in poor condition. More work is needed to explain the differences in Al, S, N and K concentration. Although acid rain may be adversely affecting forest productivity, evidence collected in this study is not considered conclusive proof. (See also W87-08401) (Cassar-PTT)
W87-08407

USE OF FOREST SITE INDEX FOR EVALUATING TERRESTRIAL RESOURCES AT RISK FROM ACIDIC DEPOSITION,
Institute of Ecology, Indianapolis, IN.
O. L. Loucks.
IN: Acid Precipitation Series, Volume 5: Direct and Indirect Effects of Acidic Deposition on Vegetation, Butterworth Publishers, Boston. 1984. p 97-109, 2 fig, 4 tab, 28 ref.

Descriptors: *Water pollution effects, *Acid rain, *Vegetation, *Forests, *Forest site index, Nutrients, Aspen trees, Neutralization, Calcium, Magnesium.

Forest site index expresses stand height growth for a given combination of soil and species over a standard time interval such that in the absence of human alteration consistent values are obtained from one forest rotation to the next. It is usually expressed as the average height of dominant and codominant trees at an age base of 25-50 years (East) of 100 years (West). Applied to tree growth data from northern Wisconsin, nitrogen levels of the soil in aspen stands showed no correlation with site index; phosphorous levels showed low correlation. Given a rainfall pH of 4.5 it was predicted that 10-30% of Ca and Mg might be leached from low-nutrient sites and 2-5% from intermediate sites. High-nutrient sites could neutralize all acid inputs without appreciable reductions in Ca and Mg stocks. Use of the forest site index in predicting change in total growth is illustrated. This index offers an integrative tool for expressing the effects on forest productivity over many decades due to changes in pollutant loads. Data can be readily converted to harvestable product or other economic terms. (See also W87-08401) (Cassar-PTT)
W87-08408

NORDIC PERSPECTIVE OF ACID RAIN: NORWAY,
Miljoeverndepartementet, Oslo (Norway).
For primary bibliographic entry see Field 5B.
W87-08499

ENVIRONMENT CANADA PERSPECTIVE OF ACID RAIN,
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W87-08505

GLYPHOSATE-SEDIMENT INTERACTIONS AND PHYTOTOXICITY IN TURBID WATER,
Commonwealth Scientific and Industrial Research Organization, Campbell (Australia). Inst. of Biological Resources.
For primary bibliographic entry see Field 5B.
W87-08510

EFFECTS OF DECAYING TOXIC BLUE-GREEN ALGAE ON WATER QUALITY - A LABORATORY STUDY,
Norges Veterinaerhoegskole, Oslo. Dept. of Food Hygiene.
K. Berg, O. M. Skulberg, and R. Skulberg.
Archiv fuer Hydrobiologie AHYBA4, Vol. 108, No. 4, p 549-563, February 1987. 7 fig, 1 tab, 18 ref.

Descriptors: *Water pollution effects, *Eutrophication, *Microcystis, *Cyanobacteria, *Drinking water, *Water pollution sources, Toxins, Bioassay, Decomposition, Lakes, Ammonification, Recreational uses.

The fate of the phycotoxins of Microcystis aeruginosa Kuetz. during decomposition of water bloom material was investigated. During an experimental period of forty days, water quality and toxin content were investigated in vitro by chemical analysis (TOC, Tot-N, nitrate, ammonia, phycobilins) and by mouse bioassays. The peptide microcystin, a toxin produced intracellularly, was present in the cells of M. aeruginosa at the start of the experiment, but could not at that time be detected in the water. A considerable leakage of the toxin into the water took place during the process of decomposition. The results indicate that toxins from decaying cyanophycean water bloom material may affect water quality, and render the water unsafe for human and animal consumption, as well as for recreational purposes. The experimental sample (including both bloom material and lake water) was collected from a natural bloom in Lake Akersvatn (Norway) on Oct. 31, 1984, and kept in a 15 l glass container for the duration of the experiment. Temperature and a 12 hr/12 hr cycle of light/dark were maintained. Instrumental methods included HPLC and UV. (Airone-PTT)
W87-08517

MUTAGENS IN WATER SOURCES: DETECTION AND RISK ASSESSMENT,
Severn-Trent Water Authority (England).
For primary bibliographic entry see Field 5A.
W87-08533

INFLUENCE OF AN ECOSYSTEM-LEVEL MANIPULATION ON PREY CONSUMPTION BY A LOTIC DRAGONFLY,
Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 2H.
W87-08534

EFFECTS OF ACIDIFICATION ON LIFE-HISTORY TRAITS OF THE FRESHWATER CLAM MUSCULIUM PARTUMEIUM (SAY, 1822) (BIVALVIA: PISIDIIDAE),
Virginia Univ., Charlottesville. Dept. of Biology.
D. J. Hornbach, and D. L. Childers.
Canadian Journal of Zoology CJZOAG, Vol. 65, No. 1, p 113-121, January 1987. 4 fig, 4 tab, 40 ref.

Descriptors: *Water pollution effects, *Limnology, *Acid rain, *Clams, *Hydrogen ion concentration, *Life History studies, *Adaptation, Species diversity, Mollusks, Growth, Survival, Calcium.

The effects of acidification on growth, survivorship and natality of freshwater clams are examined. Six groups of newborn clams (parents), collected in either October (replicate 1) or January (replicate 2), and their offspring (F1) were maintained in river water kept at a pH of 3, 4, 5, or 6 with the addition of H2SO4. A control (no acid added) had a pH near 7. Generally, growth and survivorship were poor in treatments of pH 3 and 4. Maximal growth occurred at a pH of 5, which approximates that of the stream from which these clams were collected. Clams maintained at pH 5 generally had the highest gross and net reproductive rates as well and the youngest age at first reproduction, leading to maximum values of r (intrinsic rate of increase). Usually the F1 generations had greater survivorship than their parents and under adverse conditions could attain greater shell lengths. Life history traits in M. partumeium appear to be sensitive to changes in environmental pH and populations of these clams may be able to acclimate to changing pH regimes over time, i.e., from one generation to the next. More information on the influence of acidification is needed since pisidiids can be important components of freshwater systems and since they may be important as reservoirs for alkalinity and Ca in lakes. A particularly interesting facet of future research could be the selection of acid-resistant strains of clams which could be used to buffer acidifying habitats. (Airone-PTT)
W87-08536

IMPACT OF 'ORGANIC 'POLLUTANTS ON COASTAL WATERS, GULF OF TRIESTE,
Trieste Univ. (Italy). Ist. di Idraulica.
R. Olivetti, J. Faganeli, and A. Malej.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 57-68, 1986. 2 fig, 7 tab, 24 ref.

Descriptors: *Water quality, *Organic wastes, *Water pollution effects, *Coastal waters, Gulf of Trieste, Water pollution sources, Pollutants, Suspended solids, Detergents, Nutrients, Pathogens, Effluents, Wastewater disposal.

The main sources of potential 'organic' pollutants (essentially pathogens, nutrients, floatables, suspended solids and detergent) discharged to the Gulf of Trieste by sewers and rivers are briefly reviewed; about 470,000 people live in the coastal area, and nearly 400,000 of them discharge sewage effluents to the Gulf. An evaluation was made of the impact of such discharges on the quality of marine waters, with reference to the impairment of uses such as bathing and shellfish cultivation. The

sanitary and aesthetic aspects of fecal pollution which typically affect coastal waters are examined together with the water quality standards pertaining to bathing waters and shellfish cultivation areas; the extent of pollution of the coastal waters is determined. Experience gained at some wastewater treatment and disposal works is cited. On the whole, the Gulf of Trieste appears to be in a satisfactory condition: more than 85% of the shoreline (totalling 42 km in Yugoslavia and 93 km in Italy) is unpolluted according to the pertaining standards. Ameliorations are, however, urgently needed in many respects. Recommendations regarding adequate forms of sewage treatment and disposal are made. (Author's abstract)
W87-08545

STATE OF THE ART REVIEW: AN EPIDEMIOLOGICAL APPROACH TO THE HEALTH EFFECTS OF WASTEWATER REUSE,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
H. I. Shuval, B. Fattal, and P. Yekutiel.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 147-162, 1986. 5 fig, 1 tab, 24 ref.

Descriptors: *Reviews, *Wastewater treatment, *Wastewater renovation, *Water reuse, *Wastewater irrigation, *Water pollution effects, *Epidemiology, *Pathogens, *Impaired water use, *Model studies, Public health, Irrigation, Agriculture, Pollutants, Coastal waters, Bacteria, Protozoa, Viruses, Model testing.

The reuse of wastewaters for agricultural irrigation can be a means of reducing the pollution of surface waters including those in coastal areas used for bathing. The wastewater stream of a community carries the complete spectrum of pathogenic bacteria, viruses, protozoa, and helminths which are endemic to the community. These pathogens can survive sufficiently long in the soil or on crops to infect, at least in theory, persons coming in direct contact. Thus, it is important to establish a sound epidemiological basis for health regulations related to the reuse of wastewater in agriculture. The theoretical epidemiological considerations are presented that should serve as the basis for a predictive model of the potential risks associated with wastewater irrigation. Empirical data form credible, quantifiable epidemiological studies were reviewed to validate the theoretical model. For developing countries, it was concluded that the ranking of pathogens by degree of risk associated with wastewater irrigation is: (high-risk) helminths, (medium-risk) bacteria and protozoa, and (low-risk) viruses. In order to reduce the concentration of these pathogens, wastewater treatment is recommended as the most effective control strategy. (Author's abstract)
W87-08554

POLLUTION OF THE BEACHES OF ALEXANDRIA DUE TO THE DISCHARGE OF SEWAGE: A CASE STUDY,
Alexandria Univ. (Egypt). Dept. of Environmental Health.
For primary bibliographic entry see Field 5B.
W87-08565

5D. Waste Treatment Processes

MODEL-BASED DESIGN OF WATER DISTRIBUTION AND SEWAGE SYSTEMS,
Asian Inst. of Tech., Bangkok (Thailand).
For primary bibliographic entry see Field 5F.
W87-07656

HAZARDOUS AND TOXIC MATERIALS: SAFE HANDLING AND DISPOSAL,
Fawcett Consultants, Inc., Wheaton, MD.
For primary bibliographic entry see Field 5E.
W87-07657

WASTEWATER DISINFECTION: A STATE-OF-THE-ART REPORT.
Water Pollution Control Federation, Alexandria, VA.
Water Pollution Control Federation, Alexandria, Virginia, 22314-1994. Prepared by Water Pollution Control Federation Disinfection Committee. c. 1984.78 p. 3 fig, 8 tab, 237 ref.

Descriptors: *Wastewater treatment, *Disinfection, *Legislation, *Water quality control, Drinking water, Chlorination, Water supply, Chemical treatment, Ultraviolet radiation, Coliforms, Ozonation.

Wastewater disinfection is not new; it has been practiced for many years. More than 100 years ago, chlorine and its compounds were applied directly to wastewater to control odors which were then believed to cause disease. More recently, concern has focused on the effects wastewater discharges have on drinking water supplies, on shellfish areas, and on bathing and water contact sports; the potential for disease caused by discharges is great. Typhoid, paratyphoid, cholera, and bacillary dysentery are the most important diseases caused by pathogenic bacteria; the main diseases caused by viruses are viral gastroenteritis and infectious hepatitis, and the diseases caused by protozoa are amoebic dysentery and giardiasis. Before the passage of the Clean Water Act (PL 92-500) in 1972, most disinfection criteria were based on water quality requirements as determined by individual states. In 1973, the U.S. EPA established regulations to enforce the Clean Water Act. These required that the effluents from wastewater treaatment plants meet specific fecal coliform limitations, but did not specify the method of disinfection. After that, most, if not all, states established similar disinfection requirements. In the past, chlorine has been the most common agent for disinfecting wastewater, and this is still true today. However, several other means of disinfection have received more attention recently. These include ozone, chlorine dioxide, bromine chloride, and ultraviolet radiation. Other disinfection methods which have been used, although much less frequently, are iodine, phenolic compounds, dyes, detergents, hydrogen peroxide, and various acids and alkalies. The main reason these alternate methods have received more attention is that there is concern about the effects that the use, and, occasionally, the indiscriminate use, of chlorine has on the environment. The aim of this report is to discuss current information on the advantages and disadvantages of the various methods of wastewater disinfection and their effects on the environment and public health. (Lantz-PTT)
W87-07658

IRRIGATION WITH RECLAIMED MUNICIPAL WASTEWATER-A GUIDANCE MANUAL.
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3C.
W87-07662

INTRODUCTION: CALIFORNIA'S RECLAIMED MUNICIPAL WASTEWATER RESOURCE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3C.
W87-07663

MUNICIPAL WASTEWATER: TREATMENT AND RECLAIMED WATER CHARACTERISTICS,
California State Water Resources Control Board, Sacramento. Office of Water Recycling.
T. Asano, R. G. Smith, and G. Tchobanoglous.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 2-1 to 2-26, 1 fig, 8 tab, 15 ref.

Descriptors: *Impaired water use, *Municipal wastewater, *Wastewater treatment, *Reclaimed water, *Wastewater irrigation, *Water reuse, Irrigation practices, Pretreatment of water, Water quality.

Although irrigation with wastewater is in itself an effective form of wastewater treatment (such as in slow-rate land treatment), some degree of treatment must be provided to untreated municipal wastewater before it can be used for agricultural or landscape irrigation. The degree of preapplication treatment is an important factor in the planning, design, and management of wastewater irrigation systems. The purpose of this chapter is to describe briefly: (a) the principal processes used to achieve the various degrees of preapplication treatment; and (b) the quality of the effluents produced. The information provided is intended primarily for those not familiar with municipal wastewater treatment or the characteristics of wastewater before and after treatment. (See also W87-07662) (Lantz-PTT)
W87-07664

IRRIGATION WATER QUALITY CRITERIA,
California Regional Water Quality Control Board, Sacramento. Central Valley Region.
D. W. Westcot, and R. S. Ayers.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 3-1 to 3-37, 1 fig, 14 tab, 20 ref.

Descriptors: *Impaired water use, *Water reuse, *Irrigation water, *Water quality, *Wastewater irrigation, Municipal wastewater, Water analysis, Chemical analysis, Heavy metals, Nutrients.

The quality of treated municipal wastewater depends to a great extent on the quality of the municipal water supply, nature of the wastes added during use, and the degree of treatment the wastewater has received. Generally, if the supply water used by the municipality is of acceptable quality for irrigation, the treated municipal wastewater will also be of acceptable quality, although somewhat degraded. There are few instances in California where treated municipal wastewater quality is so poor as to prevent its use for crop and landscape irrigation. The main exceptions would be in areas where salty groundwater seeps into wastewater collection systems or industrial wastewater collection systems. Because wastewaters contain impurities, careful consideration must be given to water quality in order to evaluate the possible long-term effects on soils and plants from salts, nutrients, and trace elements that occur naturally or are added during use or treatment. These effects are normally manageable if problems associated with these impurities are understood and allowances are made for them. This chapter concentrates on how to evaluate the chemical quality of treated wastewater for use in irrigating plants. As such, it does not cover water quality evaluation from standpoints of health, groundwater, or environmental protection. Water sampling and analysis methods are presented for the determination of water quality, and analytical methods for salinity, heavy metals, trace elements, and nutrients. (See also W87-07662) (Lantz-PTT)
W87-07665

SITE CHARACTERISTICS,
Nolte (George S.) and Associates, Sacramento, CA.
For primary bibliographic entry see Field 3C.
W87-07666

CROP WATER USE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2D.
W87-07667

CROP SELECTION AND MANAGEMENT,
California Univ., Davis. Dept. of Agronomy and Range Science.
For primary bibliographic entry see Field 3C.
W87-07668

WATER MANAGEMENT FOR SALINITY AND SODICITY CONTROL,
California Univ., Davis. Dept. of Agricultural Economics.
J. D. Oster, and J. D. Rhoades.

IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 7-1 to 7-20, 5 fig, 15 ref.

Descriptors: *Impaired water use, *Water reuse, *Water management, *Salinity, *Sodicity, *Wastewater irrigation, Sodium, Municipal wastewater, Crop production, Irrigation water, Soil properties.

When municipal wastewaters are used for irrigation, water management for salinity and sodicity (sodium) control will be similar to that used for fresh water sources. All irrigation waters contain salts; however, wastewaters contain more salts (200-500 mg/L) than are present in the municipal water supply. The proportion of sodium in relation to other dissolved cations is also increased. The primary concerns in water management for salinity and sodicity control are: (1) proper selection of crops: adequate salt and specific ion tolerance of the crops grown; (2) proper seed-bed management: satisfactory levels of salinity, sodicity, and specific ion concentrations in the soil seed bed during germination; (3) adequate irrigation for both crop growth and leaching; and (4) sufficient drainage to dispose of the leaching water. Management options become more limited with increasing salinity, sodicity or concentration of toxic elements and leaching and drainage needs increase. To achieve salinity and sodicity control when using any irrigation water, including municipal wastewater, for irrigation: (1) verify that soil permeability and drainage are adequate; (2) determine initial salinity and sodicity of the soil; (3) determine the chemical composition of the irrigation water: assess potential soil and crop hazards associated with its use; (4) leach to prevent salt accumulation; (5) healthy plants withstand salinity better; and (6) local cooperative extension of Soil Conservation Service staff are an excellent source of more detailed information necessarily left out of this chapter. (See also W87-07662) (Lantz-PTT)
W87-07669

ON-FARM ECONOMICS OF RECLAIMED WASTEWATER IRRIGATION,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3C.
W87-07671

HEALTH AND REGULATORY CONSIDERATIONS,
California Dept. of Health Services, Berkeley. Sanitary Engineering Section.
For primary bibliographic entry see Field 3C.
W87-07672

LEGAL ASPECTS OF IRRIGATION WITH RECLAIMED WASTEWATER IN CALIFORNIA,
Hansen, Boyd, Culhane and Mounier, Sacramento, CA.
For primary bibliographic entry see Field 6E.
W87-07673

PROCESS MODIFICATIONS FOR INDUSTRIAL POLLUTION SOURCE REDUCTION,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
L. L. Tavlarides.
Industrial Waste Management Series, Edited by James W. Patterson. Lewis Publishers, Inc., Chelsea, Michigan. 1985. 150 p.

Descriptors: *Water pollution prevention, *Process control, *Industrial wastes, *Water pollution sources, *Waste management, Industrial wastewater, Metal-finishing wastes, Electroplating, Coal gasification, Water pollution control, Phosphorus compounds, Wastewater treatment, Pulp wastes.

Potential changes in manufacturing processes which could have significant impact on pollution elimination or reduction at its source are identified for chemical and metal processing industries. The eight industries evaluated are: refining of nonferrous metals, the electroplating industry, coal conversion processes, specialty chemicals, the iron and steel industry, the paper and pulp industry, the primary aluminum industry, and the phosphate fertilizer industry. Various generic process modifications and attendant research programs which would minimize pollution problems in these and other industries are identified. In many instances, the modification can be performed with simple, proven technology by metallurgical and chemical engineers, with a significant cost savings over conventional pollution control measures. Where modifications are less well established, directions for research, development and demonstration are suggested. This volume is intended for use by chemical and other engineers who work in industry, environmental engineers who must deal with pollution generation at its source, and for students to understand the linkage between manufacturing technology and industrial pollution. (Geiger-PTT)
W87-07698

RECOVERY, RECYCLE AND REUSE OF INDUSTRIAL WASTES,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5E.
W87-07699

URBAN WATER INFRASTRUCTURE: PLANNING, MANAGEMENT, AND OPERATIONS,
Colorado State Univ., Fort Collins.
N. S. Grigg.
John Wiley and Sons, New York. 1986. 328 p.

Descriptors: *Water management, *Management planning, *Urban hydrology, *Institutional constraints, *Wastewater management, Automation, Decision making, Sewer systems, Cost analysis, Water supply, Maintenance, Hydraulic engineering, Urban planning, Urban drainage, Urban areas, Legal aspects.

Solutions to the water management problems connected with urban infrastructure will be achieved with more money for better hydraulic engineering and better management planning. This book, written for engineers, planners, and managers, describes potential solutions to the infrastructure problem. Topics covered in the 11 chapters are: managing urban water systems, cooperation and integration in the urban water system, urban water supply systems, wastewater management systems, stormwater and combined sewer systems, planning and management essentials, engineering essentials, computer-based decision support systems, managing operations and maintenance, automating operations of urban water systems, and future issues in urban water management. Two appendices discuss cost indexes for use in water management project planning, and publications of the ASCE Urban Water Resources Research Program under Murray B. McPherson. (Geiger-PTT)
W87-07703

INFLUENCE OF THE DIMENSIONAL CHARACTERISTICS OF POLYURETHANE FOAM ON HIGH RATE ANAEROBIC DIGESTION OF PIGGERY MANURE,
Ghent Rijksuniversiteit (Belgium). Lab. for Microbial Ecology.
P. Bossier, J. Poels, P. V. Assche, and W. Verstraete.
Biotechnology Letters BILED3, Vol. 8, No. 12, p 901-906, 1986. 1 fig, 2 tab, 2 ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Pig manure, *Pore size, *Polyurethane, Biogas, Biomass, Methane bacteria, Fatty acids, Diffusion, Performance evaluation.

Completed mixed anaerobic reactors containing 10 % of their working volume as polyurethane (PUR) foam, can digest heterogeneous slurries such as pig manure in a stable way at short hydraulic retention times of the order of 6 to 7.5 days. The influence of pore size and pad size of the PUR foam on the process was investigated. The PUR foam with the smallest pore size investigated (i.e. 45 pores per inch) gave the best biogas yield and biogas production rate. Pad size seemed to be one of minor importance, having no effect on the performance of the digesters within the range examined (1 to 3.6 cm rib length). Apparently, diffusion of fatty acids into the PUR pads appeared not to be rate limiting under the lab scale reactor conditions examined. (Author's abstract)
W87-07802

INTEGRATED MANAGEMENT SCHEME PRESERVES SCARCE WATER,
B. R. McLaughlin, B. K. Schimke, and D. N. Heiser.
Power Engineering POENDL, Vol. 91, No. 1, p 33-36, January 1987. 3 fig, 1 tab.

Descriptors: *Impaired water use, *Water reuse, *Electric powerplants, *Wastewater treatment, *Zero discharge, Cooling water, Cooling towers, Recirculated water.

The 320-MW coal-fired Holcomb Station of the Sunflower Electric Cooperative in the arid sandhills of western Kansas has maintained a zero-discharge water balance ever since commercial operation began in August 1983. Restricted well water is used only to replace losses from cooling tower evaporation, minimizing well water withdrawal. Cooling tower blowdown has been reduced to the minimum possible through high cycles of concentration in the cooling systems. Recycled water is used in flue gas desulfurization and bottom ash and coal handling requirements. The liquid waste treatment system is a physical/chemical system comprised of pH adjustment with lime, oxidation by diffused aeration, clarification, filtration, and final neutralization. Circulating water chemical treatment is practiced to control biological growth, suspended solids, scaling and corrosion within the condenser and associated piping. Sidestream filtration is used to control the level of suspended solids in the circulating water and, in effect, supplies filtered water for reuse within the power plant. (McFarlane-PTT)
W87-07816

RETROFIT ENDS GAS LOSSES,
Public Utility Services, Eau Claire, WI.
K. R. Zuehlke.
Water Engineering and Management WENMD2, Vol. 134, No. 1, p 20-22, January 1987.

Descriptors: *Wastewater treatment, *Methane, *Digester gas, Electrical equipment, Electric power production, Electric powerplants, Heat transfer.

A novel digester gas collection and storage system at the Eau Claire, Wisconsin, wastewater treatment plant has succeeded in halting the loss of methane gas, containing it for use in generating electricity and as a process heating source. The direct result was an immediate and lasting reduction in electric power purchased, saving the City about $6000 per month. In addition, indirect savings of $3000 monthly have been realized through utilization of heat taken from the plant's two 12-cylinder engine/generators. Most of the 2.5 million cubic feet of methane gas produced each month is retained and burned in the engine/generator units, which are capable of producing 3700 kw of power per day. Waste heat collected in manifolds above the engines and hot water from the engine cooling system are used in the process to heat sludge before it enters the primary anaerobic digesters. A tubular aluminum lattice structure and a pair of 32-34 mil thick membranes form a reticular dome structure over a 100 ft diameter digester. No methane leakage has been detected and methane odors in the plant vicinity have been eliminated. The dome can store 117,000 cu ft of methane, slightly more than one day's production. The system is expected to pay for itself in slightly over 3 years. (McFarlane-PTT)
W87-07828

FINE TUNING PROCESS LEADS TO SUCCESS,
K. Jackson, and D. Horton.
Water Engineering and Management WENMD2,

Vol. 134, No. 1, p 23, 33, January 1987.

Descriptors: *Wastewater treatment, *Oxidation, *Oxidation process, Aeration, Chlorination, Ceramics.

An old trickling filter wastewater treatment plant has been replaced with an energy-efficient ceramic fine-bubble aeration plant at Meriden, Connecticut. Sited on 10 acres, the 11.6 million gallon per day plant serves a population of 57,000 and cost $30.5 million to construct. Oxygen transfer of over 13 pounds per abiabatic horsepower is accomplished at standards conditions with air supplied by five 200 hp blowers. An effective combination of stainless steel piping is used with a PVC diffuser header system, and diffusion is accomplished with ceramic bonded fused alimina heads. Deep aeration tanks are designed with straight wall, open top construction, requiring less land use. Benefits include utilization of less manpower, because less maintenance is required, by using just one second stage aeration tank. Chlorine consumption has been cut by employing only two of the three final settling tanks. The old plant used 30-plus tons of chlorine a year, compared to 9.5 tons now, a 60 percent savings. (McFarlane-PTT)
W87-07829

CONTRACT OPS SOLVES NEW PLANT'S PROBLEMS,
R. K. Jackson, and D. W. Horton.
Water Engineering and Management WENMD2, Vol. 134, No. 1, p 30-33, January 1987.

Descriptors: *Wastewater treatment facilities, Management planning, Operating policies, Operating costs, Publicly owned treatment works.

Municipalities around the country are turning increasingly to the private sector for financial and operational services in an effort to improve efficiency. Faced with the near-completion of a new 7.5 mgd secondary treatment plant, the City of Morristown, Tennessee, realized that the new facility would require an upgraded staff with sound management and technical capabilities to meet federal and state pollution control standards and protect their large investment in treatment facilities. A shift from 12-hr/day to 24-hr/day operation would be necessary and a certified Class 4 operator would be needed. Few certified applicants appeared to have the requisite management skills. After an extensive screening procedure and contract negotiations, a full service operations and maintenance firm was selected to operate, maintain, and manage the facility so that discharge complied with all state and federal regulations. The plant has consistently met all standards and existing city personnel were absorbed by the firm and retrained, with 90 percent achieving Class 4 certification. Substantial savings in operating costs have been achieved. Effluent quality has improved significantly. Equipment downtime has been reduced. A well-trained team of personnel are in place. The City no longer has to deal with personnel administration or labor relations, or interface directly with state and federal regulatory agencies. Contract operations have proven to be a viable cost-effective method of providing wastewater treatment in a way that benefits both the community and the contractor. (McFarlane-PTT)
W87-07830

AUTOMATED APPROACH FOR AMMONIA AND TKN ANALYSIS IN WASTEWATER,
For primary bibliographic entry see Field 7B.
W87-07833

EXTRACTION OF ORGANIC CONTAMINANTS IN AQUEOUS SOLUTIONS BY PERVAPORATION,
California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.
T. Q. Nguyen, and K. Nobe.
Journal of Membrane Science JMESDO, Vol. 30, No. 1, p 11-22, January 1987. 8 fig, 2 tab, 9 ref.

Descriptors: *Wastewater treatment, *Water treatment, *Pollutants, *Organic solutes, *Membrane processes, *Separation techniques, Organic compounds, Dichloromethane, Chloroform, Bromoethane, Acetone, Ethanol, Solutes, Permeability.

The extraction of dichloromethane, chloroform, bromoethane, acetone, and ethanol in dilute aqueous solutions by pervaporation using silicone tubular membranes was studied. The solutes studied did not affect the permeation flux of water; the flux of organic compounds increased linearly with their concentration in the solutions while the water flux remained constant for all solute-water solutions. The presence of an electrolyte or another organic solute did not influence the permeation of a given solute. The permeant components appear to behave independently of each other in the permeation process. The selectivity of the silicone membrane for halogenated hydrocarbons was greater than that of cellulose acetate and microporous polytetrafluoroethylene membranes. (Author's abstract)
W87-07857

REMOVAL OF N-ALCOHOLS FROM AQUEOUS STREAMS USING MICELLAR-ENHANCED ULTRAFILTRATION,
Oklahoma Univ., Norman. Inst. for Applied Surfactant Research.
For primary bibliographic entry see Field 5F.
W87-07858

CASE HISTORY OF A FLOODING DISASTER AT A WASTEWATER TREATMENT PLANT: MCKEESPORT, PA,
McKeesport Municipal Authority Wastewater Treatment Plant, PA.
For primary bibliographic entry see Field 2E.
W87-07867

RIGHT-TO-KNOW AT A WASTEWATER TREATMENT PLANT: THE ALCOSAN EXPERIENCE,
For primary bibliographic entry see Field 9B.
W87-07868

AIR DRIVE ROTATING BIOLOGICAL CONTACTORS - PROBLEMS ENCOUNTERED AND SOLUTIONS SOUGHT: PART II,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
W. A. Sack, J. A. Williams, and J. C. Cutright.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 20, No. 2, p 12-16, March-April 1987. 3 fig, 2 tab, 20 ref.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Air drive rotating biological contactors, *Contactors, *Hydraulic machinery, Hydraulic equipment, Biomass, Alum sludge, Sludge, Water treatment facilities, Temperature effects.

In the second part of the continuing report on air drive rotating biological contactors (RBC), the influence of air rate on operational problems was detailed and a comparison of four and six inch air cups was made. Several control strategies which attempted to induce biomass sloughing from overloaded shafts were described. The major findings from the complete study of RBC operational problems were: (1) no adverse effects on RBC operation were determined as a result of alum sludge discharges from the water treatment plant; (2) low wastewater temperatures contribute to all of the operational problems; (3) lower air rates correlated well with low RPM, increased loping, and are probably a contributing factor in failure to control biomass thickness through insufficient shearing; (4) interrelationships between operational problems were noted especially that as load cell readings increased during winter, rotational speeds decreased and that severe loping coincided with lower rotational speeds; (5) six inch air cups helped stabilize RPM and reduce loping, but did not prevent buildup of excess biomass; and (6) of the control strategies attempted, the most successful to date were intermittent train starvation for temporary reductions in shaft weight, and hydraulically assisted rotation to restart stopped or badly loping shafts. (Wood-PTT)
W87-07869

INSECTS ASSOCIATED WITH WASTEWATER TREATMENT: THEIR ROLE AND CONTROL,
M. H. Gerardi, and J. K. Grimm.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 20, No. 2, p 19-22, March-April 1987. 4 fig, 1 tab, 7 ref.

Descriptors: *Wastewater treatment, *Insects, *Insect control, *Trickling filters, *Stabilization lagoons, *Stabilization ponds, Filters, Lagoons, Aquatic insects, Wastewater, Mosquitoes, Midges, Zoogloea, Bacteria, Chlorination, Hydraulic loading, Insecticides, Organic matter.

Numerous species of insects can inhabit two commonly used aerobic wastewater treatment systems: the trickling filter and the stabilization pond or lagoon. Although many of these insects contribute to the decomposition of waste, they can also create a nuisance. Flies (Diptera), moth flies, Psychodidae, and midges, Chironomidae, and springtails Poduridae, infest trickling filters. Large populations perform an important role in controlling the growth of the filter zoogloea. However, moth flies are annoying insects and should be controlled; popular measures include chlorination of the filter media, increase of hydraulic loading, and insecticidal treatment of the filter media and structure. Red midge larvae, Chironomidae, live in lagoons and help stabilize the wastewater by removing organic debris, by extending the zone of aerobic decomposition at the mud-water interface by circulating large quantities of oxygen, by contributing to the efficiency of biochemical oxygen demand and suspended solids reduction, and by returning nutrients to the lagoon to promote the growth of other aquatic life. However, large numbers of insects from lagoons can become a nuisance and public health concern. Control of midges and mosquitoes by using fish that feed on these insects or insecticides is suggested. Proper design and operation of lagoons and maintenance of aquatic and terrestrial vegetation also helps to reduce the presence and number of insects, especially mosquitoes. (Wood-PTT)
W87-07870

RECENT SEWAGE FINANCING IN PENNSYLVANIA,
Collings, Legg, Mason, Inc., Philadelphia, PA.
For primary bibliographic entry see Field 6C.
W87-07871

COLOR ENHANCES ACCURACY OF CONTINUOUS WASTEWATER ANALYSES,
For primary bibliographic entry see Field 7B.
W87-07923

EVALUATING AND SELECTING FINE BUBBLE DIFFUSERS,
Houck (D.H.) Associates, Inc., Silver Spring, MD.
D. H. Houck.
Public Works PUWOAH, Vol. 118, No. 1, p 67-70, 104, January 1987. 1 fig, 1 tab, 6 ref.

Descriptors: *Activated sludge process, *Wastewater treatment, *Fine bubble diffusers, *Aeration, *Cost-benefit analysis, Performance evaluation, Technology, Aerators, Activated sludge, Installation, Maintenance, Maintenance costs, Costs, Operating costs, Electric power costs, Economic aspects.

The options in fine/medium bubble technology and steps to take in evaluating new or retrofitted systems are described. Critical factors determining the suitability of a particular system are discussed; these include: (1) present and projected power cost structure over the life of the equipment; (2) plant size and loading, process type, aeration system configuration, and hydraulic design; (3) blower system design and hardware; (4) and O and M and staff resources available. Useful economic analyses include annual cost basis, net present worth basis, and return on investment basis. It is concluded that the decision to retrofit a plant with high-efficiency aeration equipment, or to use such a system in a

new plant, should be taken only after carefully considering technology, costs, and O and M requirements. Simple payback comparisons that divide capital costs by power cost savings based on average power costs may be highly misleading and overly optimistic. The trade-off between improved efficiency-power cost savings and O and M requirements should be thoroughly understood before proceeding. (Author's abstract)
W87-07927

FAST TRACKING TO WATER QUALITY,
Espey, Huston and Associates, Inc., Austin, TX.
W. B. Moriarty, and R. McCarty.
Public Works PUWOAH, Vol. 118, No. 1, p 75-76, 78, January 1987. 2 fig.

Descriptors: *Water quality management, *Seabrook, Texas, *Wastewater treatment facilities, *Maintenance, *Project planning, *Hydraulic engineering, Runoff, Aerators, Sludge digestion, Biodegradation, Digestion, Sludge, Flooding, Cost-benefit analysis, Sewer systems, Inspection, Planning, Engineering, Construction.

The City of Seabrook, TX decided to rehabilitate its sewage disposal facility following serious operational and maintenance problems that made it difficult to achieve discharge permit compliance. All of the old equipment is being replaced. Existing process vessels will be rehabilitated. Two new 65-ft diameter circular clarifiers will be added to enable the plant to achieve an interim capacity of 2.5 mgd average daily flow and 7.5 mgd peak. The broken square clarifier was converted into an aerobic digester. Further modifications include a new blower building and blowers to replace the overextended mechanical aerators, improvements to the sludge handling systems, and new, expanded chlorination facilities. All of these systems had to be elevated to allow the discharge of 7.5 mgd against the 100-year flood; therefore, plant hydraulics had to be completely revamped. Under a Texas Water Commission Executive Order, it was necessary to produce a complete set of contract plans and specifications for all these improvements within 28 days, and to obtain all necessary permits and award the construction in another 15 days. The project design was 'fast-tracked' and the plans completed within the allotted time. Construction is now proceeding smoothly and ahead of schedule. (Doria-PTT)
W87-07928

FORMALIZING TREATMENT PLANT MAINTENANCE,
Saint Petersburg Dept. of Public Works, FL.
A. P. S. Pillai, and L. Thomas.
Public Works PUWOAH, Vol. 117, No. 12, p 23-25, December 1986.

Descriptors: *Maintenance, *Wastewater facilities, *Water treatment facilities, *Management planning, *St. Petersburg, Florida, *Computers, Automation, Planning, Cost analysis, Safety, Training, Performance evaluation, Personnel management, Monitoring, Pumping plants, Inspection, Quality control.

The Public Utilities Department of St. Petersburg, FL underwent a major reorganization in 1982, instituting a comprehensive maintenance program that includes a computerized maintenance management system (MMS) and an apprenticeship program for plant mechanics. The MMS selected was 'equipment specific', with accounting costs posted to the particular piece of equipment being serviced. A work order system is used for control and tracking. Vibration and thermographic analysis are used for predictive maintenance. Innovative programs include a cost avoidance program, on-call program, sewer pumping stations alarm system, scheduled painting of public utilities facilities, development of do-it-now (DIN) crews, and quality control methods, including the 'quality circle concept', which involves small groups of employees meeting regularly to identify, analyze, and recommend solutions to problems. Before the reorganization, total plant reliability was 67%; it is now 95%, and maintenance expenditures have dropped by $150,000 over the previous year. (Doria-PTT)
W87-07937

CAN A SMALL TOWN TREATMENT PLANT ESTABLISH NEW STANDARDS,
A. B. Clark, and S. E. Clark.
Public Works PUWOAH, Vol. 117, No. 12, p 29-32, December 1986.

Descriptors: *Wastewater facilities, *Water quality standards, *Juneau, Alaska, *Expansion, *Planning, *Automation, *Sludge disposal, *Legal aspects, *Standards, Wetlands, Sludge drying, Sludge digestion, Sludge utilization, Permits, Odor control, Process control, Biodegradation, Digestion, Composting, Cost analysis.

The City and Borough of Juneau, Alaska, encompassing an area of 3,108 sq miles, is expanding its Mendenhall Valley Wastewater Treatment Plant to solve its liquid treatment problem, comply with its NPDES permit, and meet an EPA compliance order for discharges into the Mendenhall River. System design combines various technologies of sequencing batch reactors (SBR), egg-shaped digesters, stirred-tank heat exchangers, and composting into one plant. There is also an existing activated biofilter (ABF). The SBR is more suited to flow variations and will handle its base flow and all excess flows. This unit is run by a programmable logic controller that will automatically bring tanks on-line as required to meet the demands for flows and ensure that time requirements are met. The sludge disposal problem is being met by reducing the bulk of the sludge through anaerobic digestion and transforming it into a useful product by composting with shredded waste paper; the final compost product can be mixed with an equal amount of coarse sand and made into topsoil. The current estimate for the complete design and construction of all phases of the project is $25 million. (Doria-PTT)
W87-07938

IMPROVED LAGOON PERFORMANCE THROUGH RETENTION-TIME CONTROL,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
L. G. Rich.
Public Works PUWOAH, Vol. 117, No. 12, p 38-39, December 1986. 5 fig, 1 tab, 3 ref.

Descriptors: *Process control, *Wastewater treatment, *Aerated lagoons, *Wastewater lagoons, *Retention time, Lagoons, Performance evaluation, Algal growth, Temperature effects, Suspended solids, Biochemical oxygen demand, Algae, Wastewater management, Basins, Settling basins, Stabilization lagoons, Odor control, Oxygen, Dissolved oxygen, Monitoring.

The dual-power level, multicellular (DPMC) aerated lagoon system is reviewed. This system, becoming increasingly popular, consists of a first cell in which sufficient aerator power is applied to maintain all organic solids in suspension, followed by three cells, each of which is aerated at a power level that permits the settleable fraction of the suspended solids in the effluent from the first cell to settle. Solids that settle form deposits in which the biodegradable materials decompose in a benthal environment, emitting methane gas. Information is presented on how to operate these systems to achieve the best effluent quality. Monitoring the lagoon water temperature and varying the number of cells being used in the system will improve system performance. The system should also be designed for maximum operational flexibility; this may be accomplished by constructing the system in a parallel configuration and by providing piping and valves to rotate the order in which the cells are used in the system. (Doria-PTT)
W87-07940

SELECTIVE SEPARATION OF COMPONENTS (COPPER, NICKEL, ZINC, CHROMIUM(VI)) IN THE PROCESS OF ION-EXCHANGE PURIFICATION OF WASTE WATERS,
Gosudarstvennyi Nauchno-Issledovatel'skii i Proektnyi Inst. Redkometallicheskoi Promyshlennosti, Moscow (USSR).
L. P. Sokolova, V. V. Skornyakov, V. B. Kargman, and K. M. Saldadse.
Journal of Chromatography JOCRAM, Vol. 364, p 135-142, September 1986. 6 fig, 2 tab, 13 ref.

Descriptors: *Copper, *Nickel, *Zinc, *Chromium, *Separation techniques, *Ion exchange, *Wastewater treatment, Heavy metals, Wastewater, Industrial wastewater, Sulfuric acid, Chromatography, Sorption, Technology.

An ion-exchange method is described for purifying the acidic wastewater of non-ferrous metals treatment plants (the wash water of pickling shops containing Cu, Zn, Ni, Cr(III), Cr(IV), and free H_2SO_4 at pH = 1.5-2.5). The method has been implemented in a number of industrial plants. The acidic wastewater was purified by extracting successively a part of the components on Soviet-made selective sorbents and separating the rest of them chromatographically, yielding commodity products for industrial use. The purified water is returned into the washing baths of the etch departments of the factory and is used for washing of non-ferrous metals and their alloys after etching. The selective extraction process for chromium or copper can also be used in local wastewater treatment. (Author's abstract)
W87-07957

GAS CHROMATOGRAPHIC DETERMINATION OF ORGANIC COMPONENTS IN EFFLUENTS FROM MILLS FOR PROCESSING WASTE PAPER,
Ukrainskii Nauchno-Issledovatel'skii Inst. Tselliuloznoii Bumazhno Promyshlennosti, Kiev (USSR).
For primary bibliographic entry see Field 5A.
W87-07960

DISINFECTION OF SEWAGE SLUDGE CAKE BY AN ELECTRON ACCELERATOR,
Japan Atomic Energy Research Inst., Takasaki. Takasaki Radiation Chemistry Research Establishment.
S. Hashimoto, K. Nishimura, W. Kawakami, and H. Watanabe.
Journal of Fermentation Technology JFTED8, Vol. 64, No. 4, p 299-304, August 1986. 8 fig, 19 ref.

Descriptors: *Disinfection, *Sludge cake, *Electron accelerators, *Radiation, *Wastewater treatment, *Sludge disposal, *Gamma radiation, *Oxygen, Energy, Technology, Aerobic conditions, Anaerobic conditions, Bacteria, Survival.

Effects of radiation dose rate, electron energy, and oxygen on disinfection of sewage sludge cake were studied to obtain technological information on disinfection by radiation. Sludge films were irradiated with electron beams at different voltages and various dose rates in oxygen-containing and oxygen-free atmospheres. Without oxygen, the surviving fraction of bacteria decreased with increasing irradiation dose, but depended little on the sludge film thickness. No effects of dose rate and energy change were found in the ranges from 20 kGy/h to 65 MGy/h and from 0.5 to 2.0 MeV when the film was thin enough to allow electron beam penetration. Similar results were obtained with gamma-ray irradiation. In the oxygen-containing atmosphere, higher disinfection efficiency was obtained with thinner films and lower dose rates. (Author's abstract)
W87-07966

ADVANCED TREATMENT OF HIGH-STRENGTH WASTEWATER BY A SUBMERGED BIO-FILM PROCESS,
Osaka City Inst. of Public Health and Environmental Sciences (Japan).
H. Takamizawa, and A. Honda.
Journal of Fermentation Technology JFTED8, Vol. 64, No. 4, p 355-359, August 1986. 6 fig, 11 ref.

Descriptors: *Advanced wastewater treatment, *Submerged bio-film process, *Wastewater treatment, Technology, Performance evaluation, Tertiary wastewater treatment, Oxygen demand, Bio-

logical oxygen demand, Hydrogen ion concentration, Acclimatization, Suspended solids, Kinetics.

A submerged bio-film process was studied as a tertiary treatment to decrease the biological oxygen demand (BOD) of secondary effluent from a combined chemical-biological treatment of high-strength wastewater to below the permitted limit (30 mg/l) for waste facilities in Japan. The required operating conditions were determined to be an influent BOD to the bio-film tank of < 300 mg/l, and a BOD-surface loading of < 2 g/sq m/d. The influent pH of 9.0-12.5 did not affect treatment efficiency adversely; acclimation compensates for pH variations in this process. Removal rates of suspended solids were not influenced by BOD-surface loading. The calculated BOD removal coefficient was 0.0000257 when the influent BOD was < 300 mg/l. (Author's abstract)
W87-07967

KINETIC MODEL FOR ANAEROBIC DIGESTION OF BIOLOGICAL SLUDGE,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
S. G. Pavlostathis, and J. M. Gossett.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 10, p 1519-1530, October 1986. 6 fig, 4 tab, 21 ref. EPA Grant R 809500-01-0.

Descriptors: *Model studies, *Anaerobic digestion, *Activated sludge, *Kinetics, *Model testing, *Wastewater treatment, *Sludge digestion, Activated sludge process, Performance evaluation, Sludge, Prediction, Digestion, Water quality management, Mathematical equations, Mathematical models, Hydrolysis, Biomass, Organic matter, Particulate matter, Substrates.

A comprehensive kinetic model was developed and tested for predicting anaerobic digester performance when fed biological activated sludge (AS). It was determined that mechanisms such as death, lysis, and hydrolysis play an important role in the conversion of viable biological solids to available substrate for the anaerobic microflora. Hydrolysis of degradable, particulate, dead AS biomass is much slower than death or lysis, and is the rate-controlling step in the overall process. As a result, about 99% of the degradable, effluent chemical oxygen demand is particulate, mostly protein. The death rate coefficient of viable AS biomass under anaerobic conditions (2 per day) is more than 16 times higher than the decay coefficient under aerobic starvation conditions (0.12 per day). The four major steps in the model are: viable cell death/lysis, hydrolysis of particulate dead biomass, acidogenesis, and methanogenesis. Sensitivity analysis showed that the most important parameter is the ultimate digestibility of the sludge. The model proved to be adequate for predicting the performance of a laboratory-scale digester receiving a biological solids feed; an extension of the model for cases of combined primary and waste-activated sludge appears feasible. (Doria-PTT)
W87-07981

ROLE OF EXOCELLULAR POLYMER IN THE DESIGN OF ACTIVATED SLUDGE,
Technion - Israel Inst. of Tech., Haifa. Dept. of Chemical Engineering.
M. Sheintuch, O. Lev, P. Einav, and E. Rubin.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 10, p 1564-1576, October 1986. 13 fig, 11 tab, 24 ref.

Descriptors: *Polymers, *Sludge settling, *Activated sludge, *Bacteria, *Wastewater treatment, *Flocculation, *Model studies, *Sedimentation, Activated sludge process, Water treatment, Species composition, Kinetics, Substrates, Biomass, Respiration, Distribution, Temporal distribution, Sludge, Mathematical models, Glucose.

Reactor operating conditions affect the sludge-settling properties due to production of exocellular polymer that serves as a flocculant in the settler and population shift from flocculating bacteria to filamentous microorganisms that do not settle. A structured kinetic model that accounts for stored substrate and production of polymers, biomass, and inerts was constructed and applied to various open and closed reactor configurations, based on the observation that, in a batch reactor, the polymer is produced during endogenous respiration. The model describes well the observed temporal variation in substrate, biomass, and polymer concentration. Application of the model to continuous operation predicts increasing polymer concentration with sludge age, which is in good agreement with one study in the literature. A study in a once-through reactor, as well as others, suggests an inverse dependence. The difference is probably due to different operating modes. The study confirmed the role of the polymer in the sedimentation process. Under some conditions, however, a slow population shift to filamentous growth becomes the dominant factor. (Author's abstract)
W87-07982

BIOTREATMENT OF S-TRIAZINE-CONTAINING WASTEWATER IN A FLUIDIZED BED REACTOR,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mikrobiologisches.
W. Hogrefe, H. Grossenbacher, A. M. Cook, and R. Hutter.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 10, p 1577-1581, October 1986. 4 fig, 1 tab, 18 ref.

Descriptors: *Biological wastewater treatment, *Fluidized beds, *Triazine pesticides, *Wastewater treatment, *Biodegradation, Performance evaluation, Biological treatment, Sand, Wastewater, Industrial wastewater, Suspended solids, Nitrogen, Nutrients, Growth, Carbon, Oxygen, Oxygen deficit, Degradation, Pesticides, Herbicides, Culturing techniques.

Mixed cultures of microorganisms immobilized on sand were used to degrade s-triazine-containing industrial wastewater in a fluidized bed reactor. Immobilized cell concentrations of up to 18 g/l volatile suspended solids could be achieved with the s-triazines as sole nitrogen source for growth and carbon sources added at a C:N ratio of about 12. Maximal removal efficiencies of 80% for s-triazines could be maintained only if the biofilm thickness was limited to avoid oxygen deficiency and the carbon source and complete wastewater (< or = 50% v/v in the feed) were supplied continuously at a mean hydraulic residence time of > or = 20-25 h. (Author's abstract)
W87-07983

DEODORIZATION OF EXHAUST GAS FROM WASTEWATER AND NIGHT-SOIL TREATMENT PLANT BY ACTIVATED SLUDGE,
Osaka City Inst. of Public Health and Environmental Sciences (Japan).
J. Fukuyama, Z. Inoue, and Y. Ose.
Toxicological and Environmental Chemistry TXECBP, Vol. 12, No. 1/2, p 87-109, 1986. 6 fig, 6 tab, 16 ref.

Descriptors: *Odor control, *Exhaust gas, *Wastewater treatment, *Wastewater facilities, *Activated sludge process, Performance evaluation, Hydrocarbons, Sulfides, Hydrogen sulfide, Ammonia, Sulfur compounds, Alcohols, Organic compounds, Aeration, Water analysis, Water quality management, Nitrogen, Biological analysis, Microscopic analysis, Odors, Organoleptic properties, Activated sludge, Cost-benefit analysis.

A new deodorizing process using an activated sludge tank was developed and its efficiency and practicality were investigated for the odorous gases emitted from a wastewater treatment plant and a night-soil treatment plant. Equipment was installed in each treatment plant site and operated continuously for a few months. The efficiency of deodorization was evaluated by measuring concentrations of main odorants contained in air at the gas-inlet and the outlet of a deodorizing tank. Though large variation of the odorant concentrations was found in the influent gas during each experiment, the performance was relatively stable, and high removal rates of the odorants were obtained at all times. In the wastewater treatment plant, aromatic hydrocarbons and dimethyl sulfide, which were the main odorants, were removed from the odorous gases at the rate of about 90% or more by the activated sludge tank. In the night-soil plant, hydrogen sulfide and ammonia in the odorous gases were removed at the rate of about 96% and 100%, respectively, provided that the loading of hydrogen sulfide into the deodorizing tank was kept below 7 mg/g-MLSS/day. (Author's abstract)
W87-08004

OIL SEPARATION FROM OIL-WATER MIXTURE BY A POROUS POLY(TETRAFLUOROETHYLENE) (PTFE) MEMBRANE,
Tokyo Inst. of Tech. (Japan). Dept. of Environmental Chemistry and Engineering.
H. Unno, H. Saka, and T. Akehata.
Journal of Chemical Engineering of Japan JCEJAQ, Vol. 19, No. 4, p 281-286, August 1986. 12 fig, 1 tab, 5 ref, append.

Descriptors: *Oil recovery, *Separation techniques, *Membrane processes, *Wastewater treatment, Performance evaluation, Membranes, Oil, Viscosity, Physical properties, Rheology, Emulsions, Colloids, Mixing, Kinetics, Oil pollution.

Factors affecting oil separation from a surfactant-free dispersed oil-water mixture in a mixing tank by a poly(tetrafluoroethylene) (PTFE) membrane separator unit were investigated. The typical unit consisted of a sheet of porous PTFE membrane, a PTFE filter paper, and an acrylic perforated plate. The separation process included three steps in series: (1) attachment of dispersed oil droplets to the membrane surface; (2) penetration of the attached oil into and through the porous space within the membrane and the filter paper, and (3) release of the oil from the separation unit. The resistance of step (2) was negligible compared with the other two steps. The ratio (alpha) of the oil droplet amount separated by the separation unit to that colliding with the membrane surface was very small, at most 3%, within the experimental conditions. The effect of oil viscosity was significant and alpha was inversely proportional to the oil viscosity. (Author's abstract)
W87-08015

OZONATION RATE OF WATER-SOLUBLE CHELATES AND RELATED COMPOUNDS,
Kyushu Univ., Fukuoka (Japan). Dept. of Applied Chemistry.
S. Morooka, K. Ikemizu, H. Kamano, and Y. Kato.
Journal of Chemical Engineering of Japan JCEJAQ, Vol. 19, No. 4, p 294-299, August 1986. 11 fig, 16 ref.

Descriptors: *Ozonation, *Kinetics, *Solubility, *Chelates, *Degradation, *Heavy metals, *Wastewater treatment, Oxidation, Ozone, Performance evaluation, Magnesium, Zinc, Copper, Complexes.

Metal-EDTA complexes and related compounds were oxidized by ozone, and the destruction rates of chelates were determined over a wide range of pH values. The degradation of EDTA was initiated by the electrophilic attack of ozone on the nitrogen lone pair. Therefore, the reactivity of EDTA chelates was strongly affected by the conditional stability constant (K) which was related to the availability of the nitrogen lone pair. In the range of K < about 10,000, the formation of the coordinate bond was not sufficiently strong, and the degradation rate of the EDTA chelates was nearly equal to that of free EDTA. However, in the range of K > 100,000, the degradation rate of the EDTA chelates decreased with an increase in the stability constant. The removal rate of metals from EDTA, NTA, and IDA complexes decreased with an increase in the number of coordination sites per ligand. Approximately two molecules of ozone were needed to degrade one coordination site of each ligand. (Author's abstract)
W87-08016

INACTIVATION OF BACTERIA IN SEWAGE SLUDGE BY GAMMA RADIATION,

Baroda Univ. (India). Dept. of Microbiology.
G. A. Pandya, S. Kapila, V. B. Kelkar, S. Negi, and V. V. Modi.
Environmental Pollution, Vol. 43, No. 4, p 281-290, April 1987. 6 tab, 19 ref.

Descriptors: *Disinfection, *Sludge, *Gamma radiation, *Inactivation, *Bacteria, *Wastewater treatment, *Survival, Seasonal variation, Cultures, Anaerobic digestion, Protection, Monsoons.

The survival of certain bacterial cultures suspended in sewage sludge and exposed to gamma-radiation was studied. The inactivation patterns of most of the organisms were significantly different when irradiation was performed using sewage samples collected in the summer and monsoon seasons. The summer samples collected from the anaerobic digestor afforded significant protection to both Gram negative and Gram positive organisms. This was evident by the increase in dose required to bring about a 6 log cycle reduction in viable count of the bacterial cultures, when suspended in sewage samples instead of phosphate buffer. The observations made using monsoon digestor samples were quite different. This sewage sludge greatly enhanced inactivation by gamma-radiation in most cases. The effects of certain chemicals on the inactivation patterns of two organisms-Salmonella typhi and Shigella flexneri-were examined. Arsenate, mercury and lead salts sensitized S. typhi, while barium acetate and sodium sulfide protected this culture against gamma-radiation. In the case of Sh. flexneri, barium acetate and iodacetamide proved to be radioprotectors. The effects of some chemicals on the inactivation pattern of Sh. flexneri cells irradiated in sludge are also discussed. (Author's abstract)
W87-08057

EFFECT OF TEMPERATURE ON THE GROWTH AND BIOCHEMICAL ACTIVITIES OF ESCHERICHIA COLI IN SEWAGE,
Gulbarga Univ. (India). Dept. of P.G. Studies and Research in Microbiology.
S. M. Gaddad, and S. S. Rodgi.
Environmental Pollution, Vol. 43, No. 4, p 313-321, April 1987. 1 fig, 1 tab, 37 ref.

Descriptors: *Temperature effects, *Bacterial growth, *Escherichia, *Sludge, *Wastewater treatment, Enzymes, Stabilization ponds, Biochemistry, Ammonia, Nitrogen, Bacteria, Oxygen demand.

Studies on the role of individual species of bacteria in wastewater treatment methods, especially the effect of environmental factors and enzyme activities, are limited. In the present investigation Escherichia coli, isolated from a stabilization pond, was grown in sterile sewage at various temperatures, ranging from 10 to 50 C, and its growth and associated biochemical activities were studied. A temperature of 30 C was found to be optimum for the growth, BOD removal, NH3-N release and the activities of protease and catalase. E. coli which was once considered to be of little value in wastewater treatment, also accounted for a considerable reduction in BOD and NH3-N release. At optimum and lower temperatures, the catalase activity was proportional to the viable cell count of the bacterium. Dissolved oxygen exhibited an inverse relationship with bacterial growth and protease activity was more pronounced during the declining phase of bacterial growth. (Author's abstract)
W87-08059

ELIMINATION OF HUMAN ENTERIC VIRUSES DURING CONVENTIONAL WASTE WATER TREATMENT BY ACTIVATED SLUDGE,
Institut Armand-Frappier, Laval (Quebec). Centre de Recherche en Virologie.
P. Payment, S. Fortin, and M. Trudel.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 12, p 922-925, December 1986. 3 tab, 11 ref. National Health Research and Development Program (Canada) Grant 6605-1842-54.

Descriptors: *Enteroviruses, *Activated sludge, *Wastewater treatment, *Disinfection, Effluents, Sludge, Viruses, Isolation, Resistance, Survival.

The present study was undertaken to determine if viruses were selectively eliminated during wastewater treatment. Human enteric viruses were detected at all steps of treatment in a conventional activated sludge wastewater treatment plant. Liquid overlays and large volume sampling with multiple passages on BGM cells permitted the detection of poliovirus (serotypes 1, 2, and 3), coxsackievirus B (serotypes 1, 2, 3, 4, and 5), and echovirus (serotypes 3, 14, and 22), as well as reoviruses. The mean virus concentration was 95.1 most probable number of infectious units per liter (mpniu/L) in raw sewage, 23.3 in settled water, 1.4 in effluent after activated sludge treatment, and 40.3 mpniu/L in sludge samples. All samples of raw sewage and settled water, 79% of effluent water, and 94% of sludge samples contained viruses. The mean reduction was 75% after settling and 98% after activated sludge treatment. Poliovirus type 3 was rarely isolated after the activated sludge treatment, but was still detected in about one-third of the sludge samples. Reoviruses and coxsackkieviruses were detected at similar rates from all samples and appear to be more resistant to the activated sludge treatment than poliovirus type 3. Poliovirus types 1 and 2 were present in almost every sample of raw sewage and settled water and still found in about half of the effluent and sludge samples, indicating a level of resistance similar to that of reoviruses and coxsackieviruses. (Author's abstract)
W87-08066

ADSORPTION EQUILIBRIUM OF DOC BY ACTIVATED CARBON AND THE INFLUENCE OF PREOZONATION,
Norges Tekniske Hoegskole, Trondheim. Dept. of Chemical Engineering.
E. Kaastrup, R. S. Summers, and P. V. Roberts.
Ozone Science and Engineering OZSEDS, Vol. 8, No. 4, p 277-298, 1986. 8 fig, 5 tab, 32 ref.

Descriptors: *Model studies, *Isotherms, *Wastewater treatment, *Adsorption, *Dissolved organic carbon, *Ozonation, *Activated carbon, Equilibrium, Ozone, Preozonation.

A linear isotherm model, modified to account for a non-adsorbable fraction, was found to fit adequately the adsorption equilibrium of organic matter from a tertiary treated wastewater. The isotherm slope varied significantly among sample days, but the range of variability did not exceed a factor of two. A moderate ozone dose (0.5 g 03/g DOC) enhanced adsorbability in both laboratory and full-scale systems, whereas higher doses appeared to decrease adsorption. Preozonation had little effect on the nonadsorbable portion of DOC. (Author's abstract)
W87-08070

INFLUENCE OF OZONATION ON THE GAC ADSORBABILITY OF ORGANIC SUBSTANCES IN ACTIVATED SLUDGE EFFLUENT,
Pretoria Univ. (South Africa). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5F.
W87-08074

DEVELOPMENT OF VILLAGE WATER SUPPLY AND SANITATION IN SIERRA LEONE,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
For primary bibliographic entry see Field 5F.
W87-08086

REMOVAL OF HEAVY METALS IN ANAEROBIC UPFLOW SLUDGE BLANKET REACTORS,
Birmingham Univ. (England). Dept. of Civil Engineering.
I. Mehrotra, K. R. K. Alibhai, and C. F. Forster.
Journal of Chemical Technology and Biotechnology JCTBDC, Vol. 37, No. 3, p 195-202, March 1987. 6 fig, 2 tab, 12 ref.

Descriptors: *Heavy metals, *Anaerobic digestion, *Sludge, *Biological wastewater treatment, *Wastewater treatment, Chromium, Zinc, Lead, Isotherms, Adsorption, Performance evaluation, Cation exchange, Inhibition, Biogas, Toxicity.

The continuous removal of heavy metals by the biological solids in an anaerobic reactor was examined. The metals used were chromium (III), zinc and lead. Both competitive and non-competitive removal was studied. The results were evaluated in terms of adsorption isotherms and were compared with earlier batch studies. This suggested that the sludge acted as a cation-exchange material, with chromium having a much lower binding intensity than lead and zinc. The data also suggest that the nature of the sludge surface is of considerable significance in determining the capacity and intensity of binding. The effect of the metals on biogas formation was also examined. This showed that inhibition of the gas formation was a function of the metal concentration and that the relative toxicities appeared to be zinc>lead>chromium. (Author's abstract)
W87-08132

PRETREATMENT PROCESSES FOR GROUNDWATER RECHARGE,
Montgomery (James M.), Inc., Pasadena, CA.
G. P. Treweek.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 205-248, 4 fig, 6 tab, 26 ref.

Descriptors: *Groundwater recharge, *Wastewater treatment, *Pretreatment of water, *Water reuse, Wastewater renovation, Sedimentation, Biological treatment, Clarification, Filtration, Air stripping, Activated carbon, Disinfection.

Unplanned, indirect wastewater reuse through effluent discharge to streams and groundwater basins for subsequent downstream use by a wide variety of interests - agricultural, industrial, or domestic - has been a long-accepted practice throughout the world. Many communities at the end of major waterways, such as New Orleans and London, ingest water that already has been used as many as five times by repeated river withdrawal and discharge. Similarly, rivers or percolation basins may recharge underlying groundwater aquifers with reclaimed wastewater, which is in turn withdrawn by subsequent communities. For example, the effluent from over 140 wastewater treatment plants partially replenishes the groundwater tapped by the water supply system for London. This means of effluent disposal, known as unplanned, indirect reuse, has become a generally accepted practice. Planned, direct reuse is practiced on a smaller scale for a limited number of purposes, primarily agricultural and industrial. The terms unplanned and planned refer to whether the subsequent reuse was an unintentional byproduct of effluent discharge, or was designed as a conscious act following effluent discharge. The planned reuse schemes discussed in this chapter incorporate wastewater reclamation processes designed to meet not only effluent discharge standards, but also reuse standards promulgated by health authorities. Two major advantages exist in utilizing groundwater recharge of reclaimed wastewater as the means for replenishing freshwater resources. First, groundwater recharge takes advantage of the subsoil's natural ability for biodegradation and filtration, thereby providing subsequent in situ treatment of pretreated wastewaters. Depending on the requirements of downstream users, this in situ treatment may eliminate the need for costly physical-chemical treatment processes. Pretreatment processes discussed are: (1) primary sedimentation, (2) secondary biological treatment, (3) chemical clarification, (4) filtration, (5) air stripping, (6) GAC adsorption, and (7) disinfection. (See also W87-08137) (Lantz-PTT)
W87-08144

RENOVATION OF WASTEWATER WITH RAPID-INFILTRATION LAND TREATMENT SYSTEMS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
H. Bouwer.
IN: Artificial Recharge of Groundwater, Butter-

worth Publishers, Boston, Massachusetts. 1985. p 249-282, 6 fig, 9 tab, 34 ref.

Descriptors: *Water, *Wastewater renovation, *Infiltration, *Land disposal, *Groundwater recharge, Wastewater treatment, Groundwater movement, Aquifers, Vadose water, Evapotranspiration, Wastewater disposal.

With rapid-infiltration (RI) systems, sewage effluent or other wastewater is applied to relatively permeable soil at rates that are much higher than the evapotranspiration rates. Thus, most of the wastewater moves down to the groundwater and is renovated by filtration through the vadose zone and subsequent movement through the aquifer. This treatment aspect is becoming more and more important as the need for water reuse increases and protection of native groundwater becomes vital. For this reason, rapid-infiltration systems, increasingly called soil-aquifer treatment systems, can be a significant part of the complete treatment processes of wastewater for reuse. In most systems, the wastewater is applied to the soil with infiltration basins. On sloping land, contour terraces or furrows can be used. Where topographies are very irregular, sprinkler systems can be used, but these require additional energy for pumping and also create aerosol problems. Application or 'hydraulic loading' rates of rapid-infiltration systems typically are of the order of 20 to 150 m/yr. Since evapotranspiration rates are of the order of 0.5 to 2.5 m/yr, about 90% to almost 100% of the applied wastewater will move down to the groundwater. Rapid-infiltration soil-aquifer treatment systems are capable of removing essentially all biodegradable organics, suspended solids, and bacteria and viruses from the wastewater. They can also remove almost all the phosphorus and significantly reduce concentrations of nitrogen and heavy metals. Properly designed and managed systems produce a clear, essentially odorless renovated water that can be used for unrestricted irrigation, primary contact recreation, and other purposes. Potable use would require additional treatment, including activated carbon filtration to remove refractory or trace organics, disinfection, and possibly also reverse osmosis or other desalination. The inclusion of a natural, underground, and invisible step such as soil-aquifer treatment in the recyling of municipal wastewater for potable use undoubtedly would enhance the aesthetics and public acceptance of complete wastewater reuse. Other advantages of rapid-infiltration system include simplicity of operation of the infiltration basins, low cost of putting wastewater underground and of getting the renovation treatment in the natural soil-aquifer system, reliability of the system, and low land requirements. For example, at a hydraulic loading rate of 70 m/yr, a city of 100,000 persons with a sewage flow of 300 L/person/day would require 16 ha of infiltration basins. (See also W87-08137) (Lantz-PTT)
W87-08145

PATHOGEN REMOVAL FROM WASTEWATER DURING GROUNDWATER RECHARGE,
Arizona Univ., Tucson. Dept. of Microbiology.
C. P. Gerba, and S. M. Goyal.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 283-317, 2 fig, 10 tab, 99 ref.

Descriptors: *Pathogens, *Path of pollutants, *Fate of pollutants, *Wastewater treatment, *Viruses, *Land disposal, *Groundwater recharge, Percolation, Soil filters, Bacteria, Groundwater quality.

Many factors control the removal of pathogenic bacteria and viruses during the percolation of sewage through the soil. Most of this chapter discusses the fate of viruses in soil because of their apparent greater potential for health problems associated with land treatment. Although the presence of viruses in groundwater has been demonstrated, it would appear that with proper site selection and management the presence of viruses could be minimized or eliminated. The key is to define the processes involved in the survival and transport of pathogens in groundwater. With proper design, land treatment could be used as an effective method for reducing the number of pathogens in wastewater. With the proper soil type, viruses and bacteria can be reduced to levels as effectively as by chlorination as currently practiced, after the travel of wastewater through only a few centimeters of soil. High removals by soil can be achieved from even raw wastewater. In the soil natural processes will eventually destroy the pathogens. Thus, in groundwater recharge operations, the soil should be considered as part of the treatment process and not simply as a final disposal source. The key to operating such systems for pathogen removal is to gain an understanding of the processes involved and methods by which they can be quantified and controlled. Based on both field and laboratory experiments, several potential treatment practices may be useful in enhancing virus removal during land application of sewage. (See also W87-08137) (Lantz-PTT)
W87-08146

EPA'S RESEARCH PROGRAM ON HEALTH EFFECTS OF WASTEWATER REUSE FOR POTABLE PURPOSES,
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
H. R. Pahren.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 319-328, 31 ref.

Descriptors: *Public health, *Water reuse, *Wastewater treatment, *Groundwater recharge, *Research needs, *Potable water, Legislation, Drinking water.

Review of the U.S. Environmental Protection Agency program on the health effects of wastewater reuse indicates that a broad range of research activities, which could directly or indirectly impact water reuse through groundwater recharge, has taken place. Much knowledge has been gained during the few years the federal program has been underway. Research on potable reuse was initiated in 1974 and the federal program funding averaged about $400,000 annually through 1978. Following the 1977 amendments to the Safe Drinking Water Act, which called for special studies on the health implications involved in the reclamation, recycling, and reuse of wastewaters for drinking, funds for reuse research increased. However, the separate program on wastewater reuse was discontinued in 1981. Any activity in the future will be conducted as part of the regular drinking water base research program. (See also W87-08137) (Lantz-PTT)
W87-08147

OPERATIONS AT THE CEDAR CREEK WASTEWATER RECLAMATION-RECHARGE FACILITIES, NASSAU COUNTY, NEW YORK,
Nassau County Dept. of Public Works, Mineola, NY.
J. A. Oliva.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 397-424, 6 fig, 5 tab, 12 ref.

Descriptors: *Artificial recharge, *Water reuse, *Cedar Creek, *New York, *Wastewater treatment, *Groundwater management, Aquifers, Wastewater renovation, Groundwater recharge, Economic aspects, Potable water.

The groundwater aquifers that underlie all of Nassau County, New York, provide the sole source of potable water supply for the inhabitants of that county. These aquifers have been stressed by the increased urbanization of this area, which has resulted in increased groundwater pumpage and the contamination of the upmost aquifer, the Upper Glacial Aquifer. In order to offset these effects, the U.S. Environmental Protection Agency provided Nassau County with a grant to study the technical feasibility and cost effectiveness of advanced wastewater treatment and groundwater recharge with reclaimed wastewater. The Cedar Creek Wastewater Reclamation-Recharge Facilities are a result of that study. This chapter is a brief description of the study area, a summary of events and studies that have led to the design and construction of the Cedar Creek Wastewater Reclamation-Recharge Facilities, and a summary of the operating experiences gained at these facilities. The 39 months of operation have demonstrated the technical feasibility and reliability of wastewater reclamation in that once the problems encountered during plant start-up were resolved, the CCWRP consistently met the effluent criteria established for groundwater recharge. Once recharge operations are completed, the costs for reclamation and recharge can be compared to the cost of purchasing potable water from New York City in order to arrive at a cost-effective solution to the long-term water supply needs of Nassau County. (See also W87-08137) (Lantz-PTT)
W87-08150

GROUNDWATER RECHARGE FOR WASTEWATER REUSE IN THE DAN REGION PROJECT: SUMMARY OF FIVE-YEAR EXPERIENCE, 1977-1981,
TAHAL-Water Planning for Israel Ltd., Tel-Aviv.
For primary bibliographic entry see Field 4B.
W87-08152

MICROPOLLUTANT REMOVAL IN RAPID INFILTRATION,
Nolte (George S.) and Associates, Sacramento, CA.
R. W. Crites.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 579-608, 14 tab, 62 ref.

Descriptors: *Wastewater treatment, *Infiltration, *Land disposal, *Artificial recharge, Groundwater recharge, Biological oxygen demand, Ammonium, Phosphorus, Bacteria, Viruses.

In a rapid-infiltration land treatment system, wastewater is treated as it percolates through the soil. The wastewater is applied to moderately and highly permeable soils (such as sands) by surface spreading in level basins or by sprinkling. Treatment is accomplished by biologic, physical, and chemical means within the soil. The need for definitive information on the extent of soil treatment during rapid infiltration has been recognized. Rapid infiltration is effective in removing many wastewater constituents such as suspended solids, BOD, ammonium-nitrogen, phosphorus, bacteria, and virus and is less effective in removing other constituents such as nitrate-nitrogen, trace organics, and trace minerals. The constituents addressed in this chapter include trace organics, inorganics (those covered by drinking water standards), and microorganisms. For these three classes of constituents, the health effects, removal mechanisms, and removals in existing rapid-infiltration systems are discussed. (See also W87-08137) (Lantz-PTT)
W87-08157

GROUNDWATER RECHARGE WITH RECLAIMED WASTEWATER: LEGAL QUESTIONS IN CALIFORNIA,
Downey, Brand, Seymour and Rohwer, Sacramento, CA.
For primary bibliographic entry see Field 4B.
W87-08161

ENVIRONMENT AND SOLID WASTES: CHARACTERIZATION, TREATMENT, AND DISPOSAL.
Oak Ridge National Lab., TN.
Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. 498 p.

Descriptors: *Solid wastes, *Environmental effects, *Solid waste disposal, *Symposium, Waste disposal, Waste management, Industrial wastes, Municipal wastes, Mine wastes.

The principal purpose of this symposium was to evaluate the impact of solid waste management practices in the utility, chemical, mining, and municipal communities on human health and the envi-

ronment. The multiagency and multidisciplinary nature of the program allowed the participants to identify relevant problems and provide practical solutions in solid waste management and environmental science. Invited speakers included representatives from major industrial communities, state and federal research and regulatory agencies, leading universities, and community action groups. The objective was to improve communication between the wide range of scientific disciplines, decision-makers, and members of the industrial community and interested public relative to the implications of solid and hazardous wastes on human health and the environment. These published proceedings of the sessions provide a compilation of these concepts and discussions for the scientific community and interested public. (See also W87-08167 thru W87-08197) (Lantz-PTT)
W87-08166

COAL-FIRED POWER PLANT WASTE MANAGEMENT,
Electric Power Research Inst., Palo Alto, CA.
For primary bibliographic entry see Field 5E.
W87-08169

CASE STUDIES IN INDUSTRIAL WASTE CHARACTERIZATION,
California Dept. of Health Services, Berkeley. Hazardous Materials Lab. Section.
For primary bibliographic entry see Field 5A.
W87-08174

OPTIMIZATION OF SOLID WASTE SEPARATING SYSTEMS,
Forest Hills Gardens, NY.
F. Hasselriis.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 409-423, 4 fig, 5 tab, 7 ref.

Descriptors: *Optimization, *Waste management, *Solid wastes, *Separation techniques, Economic aspects, Municipal wastes, Metals, Glass.

Municipal solid waste (MSW) can be processed to yield products such as refuse-derived fuel (RDF), metals, and glass and to remove contaminants in the products. The economic viability of a recovery plant depends on the yield and value of the products and the cost of disposing of unusable or contaminated materials. The value of the products depends on the amount of contaminants, particularly glass. The loss of valuable materials and the quantity of products depend on the arrangement and effectiveness of the system components and operations. Optimization of solid waste separation systems can be simulated mathematically by analyzing the system as a matrix of operations, using the separation efficiencies of the individual operations, which in turn depend on performance of the equipment and MSW properties such as particle size distribution and aerodynamic properties. With sufficient data, equipment can be designed and arranged to achieve optimum yield of products with acceptable contaminant levels. The optimum economic balance can also be achieved by relating capital and operating costs to the product revenue resulting from different degrees of process refinement. (See also W87-08166) (Author's abstract)
W87-08193

LAND TREATMENT OF HAZARDOUS WASTES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 449-474, 4 fig, 12 tab, 61 ref.

Descriptors: *Waste treatment, *Hazardous wastes, *Land disposal, Waste disposal, Oil wastes, Sludge, Bioassay, Leachates, Path of pollutants, Monitoring.

Results obtained from testing with two petroleum sludges indicate that short-term bioassays can be a valuable tool for evaluating the mutagenic activity of a hazardous waste. Analysis of the refinery and petrochemical waste indicates that they are more mutagenic than crude oil and that they possess less mutagenic activity on a per-weight basis than cigarette smoke condensate. These procedures also seem adaptable for determining the treatment potential of a hazardous waste. Although mutagenic materials can be extracted from soil, methods for extraction will require further development to determine the extraction efficiency of various solvents. Determination of the extent of reduction of the hazardous characteristics of a land-applied waste is essential to the success of the land treatment method of waste disposal. Incubation studies revealed that the mutagenic activity of waste added to soils decreased over a 6-month period. This result indicates that the soil retained most of the mutagenic constituents and prevented them from entering the groundwater. Asthese systems are further developed and as the testing protocol becomes better defined, the utility of short-term bioassays for detecting and characterizing mutagens and potential carcinogens will increase. Test systems that are used as part of a monitoring system should be selected on the basis of the types of compounds in the waste and the types of damage caused by these compounds. Additional work to be performed as part of this project will include complete characterization of three additional hazardous wastes and a comprehensive greenhouse and lysimeter study to determine the treatment potential and environmental fate of hazardous waste constituents. Although additional work is needed to define more clearly the advantages and limitations of short-term testing, preliminary results indicate that short-term tests can be a valuable tool for defining the mutagenic characteristics of a waste, evaluating their treaatment potential, and evaluating their fate and mobility from land tretament disposal sites. (See also W87-08166) (Lantz-PTT)
W87-08196

PATHOGEN REDUCTION STUDIES IN EPA'S SLUDGE MANAGEMENT PROGRAM,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
J. B. Farrell.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-245430. Price codes: A02 in paper copy, A01 in microfiche. EPA Report No. EPA-600/D-84-220, August 1984. 10 p, 3 fig, 2 tab, 3 ref.

Descriptors: *Pathogens, *Wastewater treatment, *Disinfection, *Sludge, *Waste management, *Management planning, Anaerobic digestion, Aerobic digestion.

Since about 1976, EPA's Sludge Management Program has devoted a substantial portion of its resources toward evaluating existing and new sludge stabilization processes for their ability to reduce or eliminate pathogens. This presentation reviews the nature and extent of these efforts and the plans for future work. Early efforts concentrated on processes that produce a disinfected sludge, such as thermophilic aerobic and anaerobic digestion and composting. Chemical treatment processes such as limiting to pH 12, proved to be less effective than thermal processes because they did not eliminate the eggs of certain intestinal worms (e.g., Ascaris, Toxacara) which were found to be ubiquitous in sludges. Criteria for limiting potential adverse effects from pathogens in sludge applied to land, published in September 1979 (see 40 CFR, part 257), recognized the different capabilities of processes for reducing pathogens; process conditions to produce the desired reductions were drawn from the above work and are published in the criteria. Future work will include support for further development of EPA's regulations and guidance related to sludge management, to upgrading, in a cost-effective fashion, processes that reduce or eliminate pathogens in sludge, and investigation of low technology means to disinfect sludge. (Author's abstract)
W87-08209

METROPOLITAN WASTEWATER MANAGEMENT COMMISSION SLUDGE MANAGEMENT PLAN, EUGENE-SPRINGFIELD, OREGON.
Environmental Protection Agency, Seattle, WA. Region X.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-241041. Price codes A08 in paper copy, A01 in microfiche. EPA Report No. EPA 910/9-84-119, June 1984. 164 p, 2 tab, 3 ref, 3 append.

Descriptors: *Environmental impact statement, *Wastewater treatment, *Sludge, *Eugene, *Springfield, *Oregon, Environmental effects, Water quality, Groundwater pollution, Cost analysis, Ecological effects.

A Draft Environmental Impact Statement (EIS) was distributed in October of 1983 to discuss the environmental implications of managing municipal sludge in the Eugene-Springfield, Oregon area. It considered four alternative facilities and process combinations for storing, drying, and reusing sludge, and looked at four locations to house the physical facilities. The public review of the Draft has indicated that a number of these impacts are of special concern. These include: (1) potential contamination of local drinking water supplies in the vicinity of Site C if sludge components leach through storage lagoons or are carried off-site through surface drainage; (2) potential surface water quality degradation from sludge components carried off of Site C during periods of high groundwater or heavy rain; (3) potential groundwater and surface water contamination at sludge reuse sites if sludge is applied at greaater than agronomic rates; (4) conversion of 125 acres of farmland from crop production to storage, tretment, and drying of sludge; (5) possible cropping restrictions if sludge is applied at greater than agronomic rates; (6) change in bird use patterns at Site C, increasing fall and winter use by waterfowl and decreasing year-round use by passerines, with an accompanying change in the potential for bird strikes to aircraft using Mahlon Sweet Field; (7) detectable odors likely to occur within 1,000 feet of sludge lagoons/air drying beds 10-15 days/yr; (8) local user cost increase of $8.33/yr in property tax and service fees by 1990; (9) project's consistency with local and state land use planning uncertain due to current state of flux in Lane County Comprehensive Plan and Zoning Codes; and (10) property values of land adjacent to Site C possibly adversely affected if sludge facilities are not properly operated and maintained. The plan being proposed by the Metropolitan Wastewtaer Management Commission (MWMC), which represents Eugene, Springfield and Lane County, Oregon, includes a 5.5-mile digested sludge conveyance pipeline, mechanical sludge conditioning, facultative sludge lagoon storage, air drying beds, and reuse of the sludge on local agricultural land. (Lantz-PTT)
W87-08216

ANALYSIS OF SEPTIC TANK DISTRIBUTION AND SEPTAGE GENERATION RATES IN ILLINOIS,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
J. Pendowski, B. McBride, and D. Crandall.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-231174. Price codes: A05 in paper copy, A01 in microfiche. Report No. IEPA/WPC/84-003, March 1984. 69 p, 9 fig, 31 tab, 11 ref, append. EPA Grant P005626-01.

Descriptors: *Septic tanks, *Illinois, *Wastewater treatment, *Sewer systems, *Water quality control, Municipal wastewater.

The original Section 208 Water Quality Management Plan for Illinois estimated that on-site disposal served a million people in the State, roughly 18% of the total population. Until recently, conventional sewage systems were considered to be the most efficient means to meet a community's

wastewater treatment needs. However, the necessary capital and operating costs for central sewerage systems can create significant financial burdens on individuals and communities. Because of the provisions of the Clean Water Act of 1977 (PL 95-217), incentives are now available for non-centralized systems through the allotment of state level set-aside funds for on-site construction grants. This report examines the distribution and use of on-site wastewater systems in Illinois. It presents an analysis of generation and disposition of residuals resulting from on-site disposal systems (septage). The report provides: (1) a discussion of the distribution of septic tank usage and density; (2) an estimation and presentation of septage generation rates; (3) a characterization of septage disposal practices and procedures; (4) a description of the general regulatory framework for septic tank operation in Illinois; and (5) concludes with a discussion of overall recommendations for improved management. (Author's abstract)
W87-08218

SODIUM THIOSULFATE'S FATE IN ACTIVATED SLUDGE,
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 5B.
W87-08223

PHOSPHORUS UTILIZATION AND RECYCLE IN WASTE STABILIZATION PONDS,
Texas Univ. at Austin. Center for Research in Water Resources.
H. J.-S. Houng, and E. F. Gloyna.
Center for Research in Water Resources Technical Report No. CRWR-203, March 1983. 152 p, 111 fig, 18 tab, 180 ref.

Descriptors: *Phosphorus, *Stabilization ponds, *Model studies *Waste treatment, *Organic compounds, *Wastewater treatment, Mathematical models.

Waste stabilization ponds frequently provide the most economic and effective way for wastewater treatment. The fact that waste stabilization ponds do not require as much operation and maintenance and are generally not as expensive to construct as other conventional wastewater treatment processes makes the pond systems attractive. An investigation was conducted to verify the phosphorus utilization and recycle in waste stabilization pond systems and to evaluate the role of sediment in the recycle of phosphorus. Two pond systems, I and II, were operated under three different loading conditions during a period of 22 months. System I consisted of series-connected anaerobic, facultative and maturation (polishing) ponds. System II was similar to System I with the exception that there was no anaerobic pond. Pond performance was evaluated on the basis of organic removal. Total phosphorus, organic phosphorus, and inorganic phosphorus were measured on a routing basis. Two mathematical models were developed to evaluate phosphorus uptake and recycle in the waste stabilization pond systems. The model-generated data provided reliable results and proved to be consistent with the observed data. (Author's abstract)
W87-08238

BACTERIOPHAGES AS INDICATORS OF HUMAN ENTERIC VIRUSES IN ACTIVATED SLUDGE WASTEWATER TREATMENT,
Texas Univ. at Austin. Center for Research in Water Resources.
S. W. Funderburg, and C. A. Sorber.
Center for Research in Water Resources Technical Report No. CRWR-199, June 1983. 63 p, 4 fig, 2 tab, 31 ref.

Descriptors: *Bacteriophages, *Enteroviruses, *Activated sludge, *Wastewater treatment, *Austin, *Texas, Suspended solids, Pseudomonas, *Bioindicators, Escherichia coli.

The use of indigenous bacteriophage as indicators of human enteric viruses (HEV) during activated sludge treatment of domestic wastewater was examined. Enteric viruses, bacteriophage attaching one strain of Pseudomonas aeruginosa and three strains of Escherichia coli and a number of wastewater parameters were monitored in the primary effluent, secondary effluent, and secondary sludge of the Walnut Creek Wastewater Treatment plant (Austin, Texas) during June 1982. Concentrations of the coliphage, Pseudomonas phage and HEV in primary effluent averaged approximately 1,000,000 , 100,000 and 10 plaque forming units per liter, respectively. There was over 90% removal of all of these influent viruses between the primary and secondary effluents. Removal of viruses during secondary treatment appeared to be the result of rapid adsorption of influent virions to mixed liquor suspended solids (MLSS). Adsorption was followed by inactivation of the viruses during aeration of the mixed liquor. Coliphage plaques of less than or equal to 1-mm in diameter were composed of large viruses (approximately 100 micron in diameter). Plaques greater than 3-mm in diameter appeared to be the result of host infection by a much smaller virus (approximately 45 micron in diameter). Plaques between 1 and 3 mm in diameter were composed of both small and large coliphage. In the primary effluent only the concentration of Pseudomonas phage could be significantly correlated with human enteric virus levels. In the secondary effluent, neither Pseudomonas phage nor total coliphage could be correlated with HEV concentrations. (Author's abstract)
W87-08239

DETERMINATION OF EXCHANGEABLE INORGANIC NITROGEN SPECIES IN WETLAND SOILS,
Canberra Coll. of Advanced Education, Belconnen (Australia). Water Research Centre.
S. Brodrick, P. Cullen, and W. Maher.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 377-380, March 1987. 1 fig, 3 tab.

Descriptors: *Analytical methods, *Sample preparation, *Biofiltration, *Biological filters, *Inorganic nitrogen, Wastewater treatment, Biofilters, Chemical analysis, Nitrogen, Wetlands, Soil disposal fields.

Secondary treated sewage effluent is discharged through a wetland area in Australia to trap suspended and dissolved material before the water is discharged into a river. The effectiveness of the wetland in removing nitrogen species from the sewage effluent by denitrification is being evaluated, and requires a means of determining the exchangeable nitrogen species in wetland soils. Potassium chloride is commonly used to extract exchangeable nitrogen species from soils but extraction techniques vary with regard to method of agitation, the molarity of potassium chloride solution, extraction period, and solvent-to-soil ratio. This study describes attempts to use potassium chloride to extract exchangeable inorganic nitrogen species from wetland soils. The results show that the techniques usually employed to extract exchangeable nitrogen species from soils could not be used to quantify the apparent exchangeable inorganic nitrogen species in this wetland soil. It was unclear whether the extraction agent was unable to quantitatively extract exchangeable nitrogen species, or if other nitrogen forms as well as the exchangeable nitrogen species were being extracted. (McFarlane-PTT)
W87-08258

CHARACTERIZATION OF VIRUCIDAL AGENTS IN ACTIVATED SLUDGE,
James N. Gamble Inst. of Medical Research, Cincinnati, OH.
D. R. Knowlton, and R. L. Ward.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 621-626, April 1987. 5 fig, 5 tab, 33 ref. EPA Assistance agreement R810821.

Descriptors: *Virus inactivation, *Enteroviruses, *Viricides, *Disinfection, *Activated sludge, *Wastewater treatment, Viruses, Effluents, Nutrients, Microorganisms.

A comprehensive study was carried out to determine the properties of agents responsible for loss of virus infectivity in mixed-liquor suspended solids (MLSS) of activated sludge. Initial experiments revealed that model enteric viruses (poliovirus-1 and rotavirus SA-11) were irreversibly inactivated in MLSS and released their RNA genomes. Enteric viruses belonging to other genera (echovirus-12, coxsackievirus A13, reovirus-3) were also shown to lose infectivity in MLSS. Although the virucidal activity decreased at reduced temperatures, MLSS still retained significant activity at 4 C. The virucidal agents in MLSS were stable for months at 4 C, but their activity decreased approximately 50% during 4 days of aeration at 25 C. Primary effluent, the nutrient source for activated sludge, also contained virucidal activity. After centrifugation of MLSS, almost all virucidal activity was found in the particulate fraction because of inhibitory substances retained in the supernatant fraction. Decreasing or increasing the solids concentration of the particulate fraction did not increase the virucidal activity of the fraction. The effects of heat and antibiotics on the virucidal activity of MLSS, coupled with the finding that the activity can be produced in autoclaved primary effluent seeded with MLSS, strongly support the conclusion that microorganisms are responsible for this activity. Attempts to characterize the virucidal microbial components of MLSS indicated that treatments that resulted in the inactivation or removal of microorganisms also caused a loss of virucidal activity. Thus, it appears that the virucidal components of microorganisms are either short-lived or active only while bound to the organisms themselves. (Author's abstract)
W87-08287

MOBILIZATION OF PLASMID PHSV106 FROM ESCHERICHIA COLI HB101 IN A LABORATORY-SCALE WASTE TREATMENT FACILITY,
Drexel Univ., Philadelphia, PA. Dept. of Bioscience and Biotechnology.
P. Mancini, S. Fertels, D. Nave, and M. A. Gealt.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 665-671, April 1987. 2 fig, 5 tab, 16 ref. EPA Grant R812362.

Descriptors: *Gene transfer, *Waste treatment, *Escherichia, *Plasmid mobilization, Flow rates, Hybridization, Microorganisms, Enzymes, Antibiotics.

The mobilization of plasmid pHSV106 from Escherichia coli HB101, in a laboratory model waste treatment facility, by both laboratory and indigenous wastewater strains of E. coli was monitored by transfer of antibiotic resistance characteristics and by detection of pHSV106 DNA sequences in recipient cells. The mobilization was demonstrated to occur under several different treatment conditions, such as different media composition, microbial concentrations, and waste flow rates. The herpes simplex virus thymidine kinase gene was used as a hybridization marker to confirm the occurrence of the transfer. The use of the HB101 (recA mutant) host cell implies that recA functions are unnecessary for the gene transfer. (Author's abstract)
W87-08289

FATE OF VIRUSES IN ARTIFICIAL WETLANDS,
San Diego Region Water Reclamation Agency, Santee, CA.
For primary bibliographic entry see Field 5B.
W87-08293

NITRIFYING BACTERIA IN WASTEWATER RESERVOIRS,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
A. Abeliovich.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 754-760, April 1987. 4 fig, 7 tab, 21 ref. National Council for Research and Development (Israel) Grant WT406.

Descriptors: *Settling ponds, *Nitrification, *Ammonia, *Population dynamics, *Wastewater reser-

voirs, *Nitrifying bacteria, Effluents, Toxicity, Irrigation, Israel, Inhibition, Cultures.

Deep wastewater reservoirs are used throughout Israel to store domestic wastewater effluents for summer irrigation. These effluents contain high concentrations of ammonia (< or = 5 mM) that are frequently toxic to photosynthetic microorganisms and that lead to development of anoxic conditions. Population dynamics of nitrifying bacteria and rates of nitrification were studied in two wastewater reservoirs that differed in organic load and degree of oxygenation and in the laboratory under controlled conditions, both by serial dilutions in mineral medium and microscopically with fluorescein isothiocyanate-conjugated antibodies prepared against local isolates. The difference in counts by the two methods was within 1 order of magnitude. In the laboratory, an O2 concentration of 0.2 mg/liter was close to optimal with respect to growth of NH3 oxidizers on domestic wastewater, while O2 concentrations of 0.05 mg/liter supported significant rates of nitrification. It was found that even anaerobic settling ponds are capable of sustaining a viable, although not actively nitrifying, population of Nitrosomonas spp. and Nitrobacter spp., in contrast to their rapid decline when maintained anaerobically in mineral medium in the laboratory. Nitrification rates of NH3 in effluents during storage in the reservoirs were slower by 1 to 2 orders of magnitude compared with corresponding rates in water samples brought to the laboratory. The factors causing this inhibition were not identified. (Author's abstract)
W87-08294

PROPERTIES OF DESULFOVIBRIO CARBINOLICUS SP. NOV. AND OTHER SULFATE-REDUCING BACTERIA ISOLATED FROM AN ANAEROBIC-PURIFICATION PLANT,
Groningen Rijksuniversiteit (Netherlands). Dept. of Microbiology.
H. J. Nanninga, and J. C. Gottschal.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 802-809, April 1987. 6 fig, 5 tab, 36 ref.

Descriptors: *Wastewater treatment, *Sulfur bacteria, *Anaerobic conditions, *Species composition, *Sulfates, Oxidation, Microbiological studies, Sulfur compounds, Isolation, Nutrients, Fermentation, Substrates.

Several sulfate-reducing microorganisms were isolated from an anaerobic-purification plant. Four strains were classified as Desulfovibrio desulfuricans, Desulfovibrio sapovorans, Desulfobulbus propionicus, and Desulfovibrio sp. The D. sapovarons strain contained poly-beta-hydroxybutyrate granules and seemed to form extracellular vesicles. A fifth isolate, Desulfovibrio sp. strain EDK82, was a gram-negative, non-spore-forming, nonmotile, curved organism. It was able to oxidize several substrates, including methanol. Sulfate, sulfite, thiosulfate, and sulfur were utilized as electron acceptors. Pyruvate, fumarate, malate, and glycerol could be fermented. Because strain EDK82 could not be ascribed to any of the existing species, a new species, Desulfovibrio carbinolicus, is proposed. The doubling times of the isolates were determined on several substrates. Molecular hydrogen, lactate, propionate, and ethanol yielded the shortest doubling times (3.0 to 6.3 h). Due to the presence of support material in an anaerobic filter system, these species were able to convert sulfate to sulfide very effectively at a hydraulic retention time as short as 0.5 h. (Author's abstract)
W87-08298

OZONE TREATMENT OF INDUSTRIAL WASTEWATER,
Jacobs Engineering Group, Inc., Washington, DC.
B. R. G. Rice, and M. E. Browning.
Noyes Data Corporation, Park Ridge, NJ. 1981. Pollution Technology Review, No. 843. 371 p.

Descriptors: *Ozonation, *Ozone, *Wastewater oxidation, *Wastewater treatment, *Industrial wastewater, Oxidation process, Oxidation, Chemical treatment, Oxidized wastewater, Reviews.

Ozone, a powerful oxidant, offers great promise for eliminating industrial chemicals and processing byproducts from industrial wastewaters prior to discharge. This book deals with the technology for ozone oxidation as presented in the technical literature. The introductory chapter reviews oxidation processes, with special focus on chemical oxidation. A chapter on the fundamental principles of ozone technology describes the generation of ozone on a commercial scale, the various methods of contacting ozone with aqueous solutions and methods of analysis for ozone from the point of view of process controls. Industries are grouped into 20 categories which are discussed separately. Known uses of ozone for treating waters and wastewaters are described in each category. A literature survey is presented on the organic oxidation products obtained after ozonation in aqueous systems. A chapter is included that describes the biological activated carbon concept which involves ozonation to partially oxidize dissolved organic materials to render them more biodegradable. (Geiger-PTT)
W87-08419

FLOW REDUCTION: METHODS, ANALYSIS PROCEDURES, EXAMPLES,
INTASA, Inc., Menlo Park, CA.
For primary bibliographic entry see Field 5F.
W87-08428

WATER CONSERVATION AND WASTEWATER FLOW REDUCTION - IS IT WORTH IT,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W87-08432

EFFECTS OF WATER CONSERVATION ON MUNICIPAL WASTEWATER TREATMENT FACILITIES,
Jefferson Associates, Inc., San Francisco, CA.
For primary bibliographic entry see Field 3D.
W87-08433

MODEL FOR THE TRANSPORT MECHANISMS OF SOLIDS IN BUILDING PIPE DRAINS,
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
For primary bibliographic entry see Field 5F.
W87-08452

PREPARATION AND CHARACTERIZATION OF CLAY-BASED SORBENTS FOR THE REMOVAL OF TRACE LEVELS OF 2,3,7,8-TCDD FROM INDUSTRIAL WASTEWATERS,
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
K. R. Srinivasan, and H. S. Fogler.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 519-530, 5 fig, 2 tab, 19 ref.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Dioxin, *Sorption, Trace levels, Detoxification, Decontamination, Effluents, Clays, Montmorillonite, Hazardous materials, Toxins, Chlorinated hydrocarbons.

Occurrence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) as an unwanted byproduct in the synthesis of several useful commercial products was previously well documented. Removal or detoxification of this pollutant would protect the environment while allowing the use of the commercial products to continue. Removal of trace levels of the organic pollutant from large volumes of industrial wastewater (typically 3.5 milligrams 2,3,7,8-TCDD/day in 20,000,000 gallons effluent/day) can be most effectively accomplished on a suitable sorbent. Methods for the preparation and characterization of sorbents was described. Two procedures for modifying expanding clays like montmorillonite in order to enhance their binding affinity toward toxic organic molecules at trace levels in water were described. (See also W87-08471) (Wood-PTT)
W87-08491

TREATMENT AND DISPOSAL OF WASTEWATERS FROM SETTLEMENTS AND TOURIST RESORTS IN THE MEDITERRANEAN COAST - STATE OF THE ART REVIEW,
Zagreb Univ. (Yugoslavia). Faculty of Civil Engineering.
S. Tedeschi.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 13-34, 1986. 5 fig, 8 tab, 37 ref.

Descriptors: *Wastewater treatment, *Water pollution sources, *Path of pollutants, *Water pollution, *Coastal waters, *Tourism, Mediterranean Sea, Basins, Wastewater disposal, Wastewater discharge, Wastewater facilities, Sewer systems, Biological wastewater treatment, Outfall, Wastewater renovation.

The Mediterranean Sea is in comparison to the Oceans a semi-enclosed sea and represents a concentration basin as the annual water mass brought in by rivers and rainfall is smaller than evaporation. Wastewaters from settlements and tourist resorts contribute comparatively little to the total pollution of the Mediterranean and thus cannot be considered as decisive sources of the waste matter in the sea. The harmful effect of wastewaters from settlements and tourist resorts is noticeable in special local conditions, especially in areas with a poor exchange of the sea water. The most frequent manner of wastewater disposal into the Mediterranean is through its coastal discharge without any previous treatment. In the reconstruction of the existing sewerage systems and in the construction of the new systems, marine outfalls with mechanical treatment as well as short outfalls with biological treatment are applied. In some cases land treatment is applied and wastewater is used for agricultural purposes. Although the sanitation of the existing discharge and generally the control of the waste matter both require considerable financial means, all the Mediterranean countries are now making an effort to stop the further pollution of the coastal sea. (Author's abstract)
W87-08541

TOWN OF VALLAURIS (FRENCH RIVIERA - AN EXAMPLE OF A COASTAL AREA SANITATION IMPROVEMENT PROJECT,
Lyonnaise des Eaux, Cannes (France).
G. Gelas.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 35-42, 1986. 3 fig.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Wastewater, *Coastal waters, France, French Riviera, Vallauris, Sanitation, Seasonal variation, Wastewater disposal, Effluents, Computers, Tourism, Mediterranean Sea, Water pollution, Operating costs.

The Lyonnaise Des Eaux Company has managed the sanitation amenities for the town of Vallauris Golfe-Juan (a summer population of 35,000) since 1974, with a three-fold target: (1) to arrange for the collection and disposal of the sewage effluent under all circumstances, despite the influx of tourists and without causing inconvenience to users; (2) to safeguard the appearance and condition of the beaches during the summer months by canalizing the estuary flow from the valleys and by pumping the runoff water seawards; and (3) to treat the sewage from the town in order to discharge into the Mediterranean Sea a good quality effluent which will not pollute the natural environment. The targets were reached by using the most modern techniques available. Sewage collection was optimized by installing a computerized management system for the networks, with regular monitored inspections and a preventative cleaning out program carried out by specialist organizations. The sewage water was treated in a underwater plant in the Port of Golfe-Juan. This plant, which is partially automated and invisible on the site, discharges to the sea water which conforms with the foreseen purity levels at an acceptable operating cost. (Author's abstract)
W87-08542

LOW COST METHOD FOR NUTRIENT REMOVAL FROM DOMESTIC WASTEWATERS,
Nis Univ. (Yugoslavia). Dept. of Civil Engineering.
L. Ignjatovic, and P. Marjanovic.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 49-56, 1986. 4 tab, 7 ref.

Descriptors: *Wastewater treatment, *Nutrient removal, *Domestic wastes, Nutrients, Yugoslavia, Macrophytes, Water quality standards, Eutrophication, Lake Bovan, Water hyacinth, Aquatic plants, Biological oxygen demand, Ammonia, Phosphates, Temperature effects.

At the town of Sokobanja, experiments were conducted with selected aquatic macrophytes in order to remove nutrients from domestic wastewater and thus improve the effluent quality and help prevent the eutrophication of Lake Bovan. The effective use of Eichornia crassipes Martius (water hyacinth), Pistia stratiotes l. (water lettuce) and Salvinia auriculata for the removal of BOD, NH3 and PO4 was demonstrated. In the course of the experiments temperature proved to be the most significant limiting factor under local conditions. The plants are of tropical origin which makes them very suitable for use in Mediterranean countries. A special advantage of this technology also lies in the fact that the plant cannot survive in brackish water and there is no danger of their propagation into marine ecosystems. The technology can be implemented very efficiently by slightly adapting the existing stabilization ponds or by constructing new specialized systems. In any case, the economic effects can be extremely positive since there is no need for expensive equipment and skilled labor. (Author's abstract)
W87-08544

TANNERIES: A SHORT SURVEY OF THE METHODS APPLIED FOR WASTEWATER TREATMENT,
Ministry of Physical Planning, Housing and Environment, Athens (Greece).
D. Tsotsos.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 69-76, 1986. 4 tab, 8 ref.

Descriptors: *Wastewater treatment, *Tannery wastes, *Industrial wastewater, Effluents, Wastewater, Chromium, Sulfides, Pretreatment of wastes, Sludge, Activated sludge process, Biological wastewater treatment, Surveys.

A short description of the tannery production process is given, mentioning the main points related to an effluent discharge. Qualitative and quantitative data are presented and several methods used for wastewater treatment are also reviewed. It is stated that biological systems (activated sludge) cannot be operated in the same way as for municipal effluents, since the main pollutants (Cr-salts, sulfides) negatively affect the action of the microorganisms. Therefore, a pretreatment step is required prior to the effluent discharge into a municipal treatment plant. Another problem is the treatment and disposal of the precipitated sludge. Several already applied methods trying to eliminate the problem are discussed. All represented data are taken from research studies published in international literature. (Author's abstract)
W87-08546

SYSTEMS AND SOLUTIONS FOR WASTEWATER TREATMENT IN THE BIGGEST YUGOSLAV OIL REFINERY,
INA Refinery of Rijeka, Industrijska (Yugoslavia). Dept. for Environmental Protection.
B. Legovic, and O. Nikolic.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 85-90, 1986. 1 fig, 4 tab.

Descriptors: *Wastewater treatment, *Oil refineries, *Industrial wastewater, Oil wastes, Oil, Yugoslavia, Oil industry, Industrial plants, Wastewater facilities, Sewer systems, Primary wastewater treatment, Flocculation, Biological wastewater treatment, Oxidation process, Sludge.

Wastewater treatment technology at the INA Oil Refinery of Rijeka which was applied in the past, and that which was instituted in the early eighties in response to stricter discharge standards was described. The refinery of Rijeka, built in the middle of the sixties, was not designed with water economy and water treatment in mind: its water consumption was very high and the polluted and clean water streams were intermixed in the combined sewer system. This resulted in high wastewater flows and in high pollutant loads per ton of crude oil. Now, the wastewater treatment program includes in-plant control measures and a modern wastewater treatment plant. The in-plant control includes the pretreatment of sour condensates and of the recirculating water, and cooling and collecting each category of wastewater in separate sewer system. This modern wastewater treatment plant includes primary treatment, the thorough removal of emulsified oil and colloidal solids in the flocculation and flotation unit and the removal of dissolved organic materials by biological oxidation. The sludges are incinerated in a fluidized - bed type of incinerator. (Author's abstract)
W87-08548

RECENT DEVELOPMENTS IN THE TREATMENT OF OILY EFFLUENTS,
Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. de Chimie et Genie de l'Environnement.
H. Roques, and Y. Aurelle.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 91-103, 1986. 11 fig, 1 tab, 7 ref.

Descriptors: *Wastewater treatment, *Oil pollution, *Oil spills, *Oily water, Effluents, Pollutants, Stokes' Law, Mathematical equations, Coalescence, Fluid drops, Flotation, Density, Wettability.

After reviewing the nature and importance of the environmental problems caused by oil spilled on seawater, several treatment possibilities were listed based on Stokes' Law. The results obtained in three of these directions are discussed: (1) the increase of the drop-size (coalescence); (2) the increase in the differential density (flotation); and (3) the use of preferential wettability of some materials for recovering the surface oil film. In most cases, process efficiency of oil separation is the product of a collision probability between the oil drop and another drop (or bubble) and a collision efficiency characteristic of this kind of interaction. (Author's abstract)
W87-08549

INVESTIGATION OF THE TREATMENT AND RECYCLING OF OIL REFINERY WASTEWATER,
Titograd Univ. (Yugoslavia). Inst. of Chemistry.
D. Miskovic, B. Dalmacija, Z. Zivanov, E. Karlovic, and Z. Hain.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 105-114, 1986. 5 fig, 8 tab, 11 ref.

Descriptors: *Wastewater treatment, *Oil refineries, *Wastewater renovation, *Water reuse, Industrial wastewater, Oil industry, Wastewater, Oil, Effluents, Recycling, Flotation, Sedimentation, Biological wastewater treatment, Activated carbon, Adsorbents, Chemical oxygen demand, Nitrogen compounds, Denitrification, Activated sludge.

High level purification of the wastewater from an oil refinery was investigated using some improved methods yielding an effluent suitable for recycling into the process. All the investigations were carried out on a continuous laboratory pilot system consisting of the following units: dissolves air flotation (DAF), sedimentation, double-stage microbiological reactor, and adsorption columns filled with granular biologically activated carbon (GBAC). A high degree of COD reduction close to 100% (precisely 99.95%), as well as removal of nitrogen compounds of 72% was achieved during a relatively short retention time within the range of 15-16.5 hours. The DAF technique combined with gravitational separation was used to achieve the recovery of free oil matter up to 98%, without any preliminary conditioning. After the sedimentation of coagulated and flocculated dispersed oils, the microbiological oxidation of dissolved matter was accomplished using two kinds of activated sludge for easy and hard degradable organics. Using the continuously biogenerating GBAC, an effluent having a lowered COD value to about 9 was obtained. At the same time, the denitrification process took place. According to the obtained results, the treated oil refinery wastewater can be recycled into the process or discharged into a water recipient of a low self-purifying capacity. (Author's abstract)
W87-08550

MICROBIOLOGICAL ASPECTS OF THE TREATMENT OF JOINT OIL REFINERY AND MUNICIPAL WASTEWATERS,
Banja Luka Univ. (Yugoslavia). Inst. of Biology.
O. Petrovic, B. Dalmacija, D. Miskovic, M. Gantar, and S. Gajin.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 115-123, 1986. 5 fig, 27 ref.

Descriptors: *Wastewater treatment, *Oil refineries, *Industrial wastewater, *Municipal wastewater, *Microbiological wastewater treatment, *Combined wastewater, Bacteria, Primary wastewater treatment, Secondary wastewater, Activated sludge, Activated carbon, Organic loading, Nitrogen compounds.

The bacteriological parameters of both the primary and secondary microbiological treatment of mixed oil refinery and municipal wastewaters were analyzed. Primary treatment was performed using activated sludge in a two grade bioreactor; for the secondary treatment, four columns with granular activated carbon were used. The first and the last columns were aerated, whereas the two in the middle were not. The ratios of the oil refinery to municipal wastewaters in the mixtures were 85:15, 70:30, 50:50, and 30:70. The microbiological analyses included the total bacteria count (direct method), the number of heterotrophs and oligotrophs with ratios, number of coliforms, and nitrifying and denitrifying bacteria (growing method). Activated sludge as well as microbial community on the activated carbon were investigated using scanning electron microscopy. Chemical parameters, such as pH, COD, BOD, NH4(+), NO2(-) and NO3(-), were determined by the standard methods. The performed microbiological analyses validated the joint oil refinery and municipal wastewater treatment. The decrease of the organic load in purified water ranged from 88 to 96% (COD estimate) and from 91 to 99 % (BOD estimate) while removal of individual groups of organisms varied from 55 to 99%. The highest decrease was observed in the coliform bacteria (97-99%). It is worth noting that a decrease in the total nitrogen in the system ranged from 59 to 74% and that of nitrate from 56 to 61% after secondary microbiological treatment. (Author's abstract)
W87-08551

TREATMENT OF OLIVE OIL WASTE WATERS,
Naples Univ. (Italy). Facolta di Ingegneria.
L. Mendia, P. Carbone, G. d'Antonio, and M. Mendia.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 125-136, 1986. 9 fig, 3 tab, 4 ref.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Olive oil industry, Wastewater, Mediterranean countries, Pollutants, Pollution load, Chemical properties, Municipal wastewater, Olive oil, Soil contamination, Sewers.

Olive oil production is well distributed among the Mediterranean countries. Different levels of processing technology and different industrial organizations co-exist. The production cycle is seasonal and usually concentrated in the fall-early winter period. The pollution characteristics of this industry are peculiar because the flow rates are relatively small while the pollutant load is extremely high and difficult to abate because of the inherent characteristics of low pH and high concentrations of suspended matter, organic matter and lack of nutrients. The free disposal of such wastewaters into the environment, though fairly common practice, has disasterous effects on the soil, on aquatic bodies, sewers and on urban wastewater treatment

plants. Factory specific pre-treatment is too complex and expensive to be realistically adoptable. A territory integrated solution strategy is therefore preferable and a few treatment schemes were presented. The recovery and exploitation of the by-products can be justifiable while a realistic consideration of the local realities must be kept in mind. Research is still required to improve and optimize some phases of treatment. (Author's abstract)
W87-08552

COMBINED MICROBIOLOGICAL AND ADVANCED TREATMENT OF OIL REFINERY AND MUNICIPAL WASTEWATERS,
Titograd Univ. (Yugoslavia). Inst. of Chemistry.
B. Dalmacija, D. Miskovic, Z. Zivanov, and O. Petrovic.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 137-146, 1986. 4 fig, 5 tab, 10 ref.

Descriptors: *Wastewater treatment, *Oil refineries, *Industrial wastewater, *Municipal wastewater, *Microbiological wastewater treatment, *Combined wastewater, Bacteria, Primary wastewater treatment, Secondary wastewater, Activated sludge, Activated carbon, Organic loading, Nitrogen compounds, Nitrates.

Primary microbiological purification of mixed oil refinery and municipal wastewater was studied using the active sludge process in a two-stage laboratory set-up. The advanced-secondary microbiological treatment of the mixed wastewaters was accomplished using biologically active carbon. The highest total effect of the organic matter removal for both the primary and secondary microbiological treatment was achieved when the two wastewaters were mixed in the ratio of 1:1, and it ranged from 97.7 to 99.2%. The organic matter load in the effluent expressed as BOD sub 5, was 0.3-5.7 milligrams O2/cu dm. When conditions in the columns containing biologically active carbon were changed from aerobic to anaerobic, the denitrification bacteria were allowed to use the adsorbed organic matter as the substrate. In this way, the achieved nitrate removal was up to 72%. It was found that active carbon adsorbed the organic matter 1.37-2.10 times more than its adsorption capacity, while the free surface degree was in the range of 44.5-59.7%. On the basis of the obtained results, the kinetic coefficients were calculated for both the primary and secondary microbiological treatment of the mixture of the oil refinery and municipal wastewaters. Finally, two alternatives of the technological procedure were proposed for such treatment. (Author's abstract)
W87-08553

STATE OF THE ART REVIEW: AN EPIDEMIOLOGICAL APPROACH TO THE HEALTH EFFECTS OF WASTEWATER REUSE,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
For primary bibliographic entry see Field 5C.
W87-08554

REUSE OF WASTEWATERS IN AGRICULTURE BY MEANS OF SPRINKLER IRRIGATION ON A FARMLAND AREA OF 3000 HA - LARGE SCALE EXPERIENCE IN GERMANY,
Technische Univ., Brunswick (Germany, F.R.). Inst. fuer Standbauwesen.
For primary bibliographic entry see Field 3C.
W87-08555

PROBLEMS ASSOCIATED WITH PARTICULATE MATTER IN WATER REUSE FOR AGRICULTURAL IRRIGATION AND THEIR PREVENTION,
Hebrew Univ., Jerusalem (Israel). School of Applied Science and Technology.
A. Adin.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 185-195, 1986. 3 fig, 2 tab, 3 ref.

Descriptors: *Wastewater treatment, *Wastewater irrigation, *Impaired water use, *Wastewater renovation, *Water reuse, *Particulate matter, Irrigation, Surface irrigation, Sprinkler irrigation, Drip irrigation, Irrigation water, Water quality, Impaired water quality, Clogging, Filters, Water quality standards, Water quality management, Water treatment, Water distribution.

Methods of irrigation are reviewed, including surface irrigation, sprinkler irrigation, and drip irrigation, and the problems of these systems with regard to the quality of the water used are described. Surface irrigation does not suffer much from water quality problems, but both sprinkler irrigation and drip irrigation systems are affected more. The main problem is clogging of pumps, pipes and orifices. Clogging is usually due to a combination of suspended matter, chemical precipitation and biological growth. Current solutions through water treatment and the resulting problems are described. Examples are given of typical strainers and filters. The key to the solution of clogging problems is a proper match between water quality of the source and within the distribution system, and the type of treatment to be used. Therefore, proper water quality monitoring is recommended. Direct granular filtration is the preferable treatment process for drip irrigation systems. (Author's abstract)
W87-08557

FROM COASTAL WATER POLLUTION CONTROL TO THE RECLAMATION OF SEWAGE,
For primary bibliographic entry see Field 5E.
W87-08566

5E. Ultimate Disposal Of Wastes

MICROBIAL RELEASE OF 226RA(2+) FROM (BA,RA)SO4 SLUDGES FROM URANIUM MINE WASTES,
Alberta Univ., Edmonton. Dept. of Chemistry.
P. M. Fedorak, D. W. S. Westlake, C. Anders, B. Kratochvil, and N. Motkosky.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 262-268, August 1986. 4 fig, 2 tab, 21 ref. Energy Mines and Resources Canada Contract No. 1ST 83-00325.

Descriptors: *Bacterial physiology, *Sludge digestion, *Sludge disposal, *Uranium, *Mine wastes, *Radium radioisotopes, *Sulfates, *Barium, *Microbiological studies, Waste, Sludge, Industrial wastes, Radioisotopes, Radioactivity, Heavy metals, Bacteria, Heterotrophic bacteria, Aerobic bacteria, Anaerobic bacteria, Sulfur bacteria, Wastewater treatment, Coagulation, Chemical coagulation, Canada, Nitrogen, Phosphates, Nutrients, Culturing techniques, Sulfides, Water quality management.

226Ra(2+) is removed from uranium mine effluents by coprecipitation with BaSO4. A study was undertaken to determine the bacterial content of (Ba,Ra)SO4 sludges from active mine sites and to examine factors affecting the activities of these indigenous floras that might result in the dissolution of 226Ra(2+) from such sludges. (Ba,Ra)SO4 sludge samples from two Canadian mine sites were found to contain active heterotrophic populations of aerobic, anaerobic, denitrifying, and sulfate-reducing bacteria. In the laboratory, sulfate reduction occurred in batch cultures when carbon sources such as acetate, glucose, glycollate, lactate, or pyruvate were added to samples of (Ba,Ra)SO4 sludge. No external sources of nitrogen or phosphate were required for this activity. Further studies with lactate supplementation showed that once the soluble SO4(2-) in the overlying water was depleted, Ba(2+) and 226Ra(2+) were dissolved from the (Ba,Ra)SO4 sludge, with the concurrent production of S(2-). Levels of dissolved 226Ra(2+) reached approximately 400 Bq/liter after 10 weeks of incubation. Results suggest that the ultimate disposal of these sludges must maintain conditions to minimize the activity of the indigenous sulfate-reducing bacteria to ensure that unacceptably high levels of 226Ra(2+) are not released to the environment. (Author's abstract)
W87-07596

HAZARDOUS WASTE MANAGEMENT,
Battelle Pacific Northwest Labs., Richland, WA.
G. W. Dawson, and B. W. Mercer.
John Wiley and Sons, New York, New York, 1986. 532 p.

Descriptors: *Hazardous wastes, *Waste management, *Waste disposal, Landfills, Wastewater treatment, Incineration, Disposal sites.

This handbook addresses issues of concern for the regulator, the waste generator, the operator, and the local planners. As such, the text deals with waste management issues at several levels: (1) philosophical, with respect to constructing an overall framework for management; (2) technical, with respect to the selection and design of specific approaches; (3) economic, with respect to the relative cost of alternatives; and (4) sociological, with respect to the growing need for public interface and approval. The material presented here incorporates both the empirical results of widespread research and development efforts and the opinions of the authors based on their observations and experience at all levels of the management network. This book: discusses the current debate over landfills; reviews inventory waste techniques and recent data on common waste sources; describes the wide variety of treatment processes and how to select the best one to handle a specific problem; compares the multiple alternatives to incineration; provides a proven method for predicting heat release whenever incineration is employed; and presents possible solutions to the abandoned waste site problem. (Lantz-PTT)
W87-07652

HAZARDOUS AND TOXIC MATERIALS: SAFE HANDLING AND DISPOSAL,
Fawcett Consultants, Inc., Wheaton, MD.
H. H. Fawcett.
John Wiley and Sons, New York, New York. 1984. 296 p.

Descriptors: *Toxic wastes, *Hazardous wastes, *Waste disposal, *Toxicity, *Wastewater treatment, Containment systems, Legislation, Regulations, Economic aspects, Legal aspects.

This book presents the latest scientific information about hazardous and toxic materials, their containment, and their availability to man, animals and plants. A close look is taken at the laboratory where most of these materials originate. Fire and explosion hazards and their detection are discussed. Detailed is the personal protection for the body, head, feet, and respiratory system that's necessary in the waste site investigation and clean-up environments. The legal applications of RCRA and SUPERFUND - the enforcement laws and financial base - are discussed at length. Theres also an updated analysis of the most widely misunderstood chemical of all time, dioxin. A special Appendix lists 5446 'National Priority Sites' which are broken down geographically. (Lantz-PTT)
W87-07657

PROCESS MODIFICATIONS FOR INDUSTRIAL POLLUTION SOURCE REDUCTION,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5D.
W87-07698

RECOVERY, RECYCLE AND REUSE OF INDUSTRIAL WASTES,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
K. E. Noll, C. N. Haas, C. Schmidt, and P. Kodukula.
Industrial Waste Management Series, Edited by James W. Patterson. Lewis Publishers, Inc., Chelsea, Michigan. 1985. 196 p.

Descriptors: *Waste recovery, *Wastewater renovation, *Recycling, *Waste management, *Industrial wastes, Separation techniques, Wastewater treatment, Hazardous materials, Sorption, Chemical treatment, Filtration, Water resue, Adsorption, Physicochemical treatment, Organic compounds.

An attempt is made to identify technological limitations associated with unit processes currently or potentially employed for separation of organic and inorganic pollutants from various industrial waste streams by reviewing, evaluating, and summarizing information pertaining to the state-of-the-art for these fields. The first section of the book consists of chapters on the methodologies currently available for recovery of industrial and hazardous waste, and developing technology for recycle, reuse, and recovery. The second section of the book contains chapters concerned with five technical categories used for recovery; namely, sorption, molecular separation, phase transition, chemical modification, and physical dispersion and separation. Individual unit processes are presented with a brief discussion of process operation, applications, and the technological advantages and limitations of the process. At the present time, economics seem to be a major factor in determining if recycle, recovery and reuse of industrial pollutants are appropriate. However, current economic costs do not take into account any hidden costs to society due to environmental pollution and depletion of natural resources. Industrial waste managers may benefit from the non-technical overviews provided along with the discussions of economic implications of recovery, recycle and reuse. (Geiger-PTT)
W87-07699

WASTES IN THE OCEAN, VOLUME 6: NEARSHORE WASTE DISPOSAL.
John Wiley and Sons, New York, New York. 1985. 534 p. Edited by Bostwick H. Ketchum, Iver W. Duedall, Judith M Capuzzo, P. Kilho Park, Wayne V. Burt and Dana R. Kester.

Descriptors: *Waste disposal, *Coastal waters, *Ocean dumping, *Water pollution effects, *Path of pollutants, Sludge, Industrial wastes, Dredging, Marine environment, Geochemistry, Legal aspects.

Nearshore areas are rapidly becoming repositories for anthropogenic wastes such as sewage sludge, industrial effluents, and dredged material. If the world population continues to grow at its present rate, society's demand on the coastal zone will increase and degradation of the nearshore environment will become more pronounced - compromising its desirability for aesthetic and recreational purposes and its use as a resource. Understanding the processes affecting waste transport and long-term consequences of contaminant accumulation requires an interdisciplinary approach; physical, chemical, and biological processes are equally important. Waste management strategies are not based on scientific evidence alone, but require an integration of scientific social, and legal considerations. This volume focuses on several aspects of nearshore waste disposal: Part I is a summary of nearshore processes and the effects of waste disposal on the nearshore environment; Part II includes studies of the availability of contaminants to marine organisms, the effects of these contaminants, and the use of a bacterium to monitor sewage movement and deposition; Part III is an examination of the geochemistry of waste disposal site sediments and waters; Part IV includes experimental tracking of disposed wastes and the physical processes of waste transport; Part V evaluates some of the societal, legal, and policy implications associated with the disposal of wastes in nearshore areas; and Part VI presents an analysis of future strategies for waste disposal. (See also W87-07730 thru W87-07749) (Lantz-PTT)
W87-07729

IMPACT OF WASTE DISPOSAL IN NEARSHORE ENVIRONMENTS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
J. M. Capuzzo, W. V. Burt, I. W. Duedall, P. K. Park, and D. R. Kester.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 3-38, 6 fig, 6 tab, 132 ref.

Descriptors: *Fate of pollutants, *Coastal waters, *Waste disposal, *Water pollution effects, *Path of pollutants, *Ocean dumping, Marine environment, Heavy metals, Compounds, Organic carbon, Nutrients, Ecosystems.

The distribution, fate, and effects of wastes in nearshore coastal environments are governed by the physical, chemical, and biological processes that reduce the concentration or alter the chemical form or bioavailability of wastes and remove such contaminants from the water column. The disposal of wastes in nearshore environments results in the input of several classes of contaminants, including metals, organic compounds of synthetic (xenobiotic) and natural origin, organic carbon, nutrients, and pathogens. Organic carbon and nutrients are readily biodegraded or assimilated and may stimulate biogeochemical cycles. Metals, xenobiotic compounds, and pathogens may accumulate and persist in marine organisms and sediments and result in transfer between trophic levels or changes in the functioning of marine ecosystem. Disposal of wastes should occur in areas where horizontal dispersion would distribute wastes over a wide geographical area in order to minimize organic carbon loading, accumulation of toxic metals and organic contaminants, and accumulation of pathogens in natural resources. This approach would minimize the overloading of natural microbial and biogeochemical processes, prevent severe alterations in the structure and function of macrobenthic communities, and minimize accumulation of pathogens in restricted areas of the benthos. Management decisions for waste disposal are not based solely on scientific criteria. Such criteria are evaluted within the existing legal framework and social acceptance. (See also W87-07729) (Lantz-PTT)
W87-07730

BIOAVAILABILITY AND EFFECTS OF HEAVY METALS IN MARINE DEPOSITS,
Marine Biological Association of the United Kingdom, Plymouth (England).
For primary bibliographic entry see Field 5C.
W87-07731

ACCUMULATION OF POLYNUCLEAR AROMATIC HYDROCARBONS BY THE CLAM MYA ARENARIA,
Department of Fisheries and Oceans, St. Andrews (New Brunswick).
For primary bibliographic entry see Field 5B.
W87-07732

USE OF BACTERIA, CLOSTRIDIUM PERFRINGENS, IN MARINE SEDIMENTS AS A MONITOR OF SEWAGE PARTICULATE DEPOSITION AND MOVEMENT,
Rhode Island Univ., Kingston. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W87-07733

GILL BLACKENING AND FOULING IN THE ROCK CRAB, CANCER IRRORATUS, AS AN INDICATOR OF COASTAL POLLUTION,
National Marine Fisheries Service, Oxford, MD. Oxford Lab.
For primary bibliographic entry see Field 5C.
W87-07734

BIOLOGICAL EFFECTS OF DREDGED-MATERIAL DISPOSAL IN ALBERNI INLET,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
For primary bibliographic entry see Field 5C.
W87-07735

HYDROCARBONS IN SOUTHERN CALIFORNIA MUNICIPAL WASTES AND THEIR INPUT TO COASTAL WATERS,
Massachusetts Univ. at Boston. Environmental Science Program.
For primary bibliographic entry see Field 5A.
W87-07736

MODELING EXCHANGEABLE MINOR CATION ADSORPTION IN MARINE SEDIMENTS: PROCESS AND CONTROL OF NH4(+) ADSORPTION,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5B.
W87-07737

FATE OF METALS IN THE SEDIMENTS OF THE NEW YORK BIGHT,
National Mariculture Centre, Eilat (Israel).
For primary bibliographic entry see Field 5B.
W87-07738

METALS IN INTERSTITIAL WATERS OF THE NEW YORK BIGHT DREDGED-MATERIAL DEPOSIT,
Dynamics Solutions Corp., Pasadena, CA.
For primary bibliographic entry see Field 5A.
W87-07739

ORGANIC POLLUTANTS IN NEW YORK BIGHT SUSPENDED PARTICULATES,
Battelle New England Marine Research Lab., Duxbury, MA.
For primary bibliographic entry see Field 5B.
W87-07740

GEOCHEMISTRY OF THE DALHOUSIE OCEAN DUMPSITE,
OceanChem Ltd.., Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5B.
W87-07741

ENERGETICS OF DREDGED-MATERIAL DISPERSAL,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W87-07742

SEDIMENT BUDGET NEAR THE NEW YORK BIGHT DUMPSITES: IMPLICATIONS FOR POLLUTANT DISPERSAL,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 2J.
W87-07743

ACOUSTIC STUDY OF DREDGED-MATERIAL DUMPING IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W87-07744

CONTINUOUS MEASUREMENT OF THE DISPERSION OF SEWAGE SLUDGE,
Brookhaven National Lab., Upton, NY.
For primary bibliographic entry see Field 5B.
W87-07745

MINING WASTE DISPOSAL IN NORWAY: A CONFLICT BETWEEN FISHERIES AND INDUSTRY,
Fiskeridirektoratets Havforskningsinstitutt, Bergen (Norway).
L. Foyn.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 411-420, 3 fig, 1 tab, 7 ref.

Descriptors: *Coastal waters, *Path of pollutants, *Ocean dumping, *Mine wastes, *Norway, *Waste disposal, *Fisheries, *Jossingfjord, Fish toxins, Industrial wastes, Titanium, Case studies.

Jossingfjord has been used since 1960 as a site for disposal of waste from titanium mining. In 1975 the mining company asked for permission to use a deep trench outside the fjord as a new dumpsite for the disposal of mining waste at the rate of 2,200,000 t/yr. The waste contains about 10% small particles that are easily dispersed and can be spread over a wide area, blanketing the seafloor with black mud. The use of floating oils in the ore-refining oper-

ations has led to tainting of fish caught in the area of disposal. In 1980 permission was given for the use of the trench, Dyngadjupet, for disposal. The local fishermen's societies protested, and the Ministry of Fisheries has reacted to their protest. The final decision to permit ocean disposal will now be considered by the Norwegian Cabinet. The Institute of Marine Research has, in its advice to the government, pointed to possible pollution problems in a wide area presently used as a valuable fishing grounds for about 150 local fishermen, in addition to being an important spawning and breeding area for commercially important species. (See also W87-07729) (Author's abstract)
W87-07746

UNITED STATES MARINE WASTE DISPOSAL POLICY,
National Oceanic and Atmospheric Administration, Washington, DC. Office of General Counsel.
For primary bibliographic entry see Field 5G.
W87-07747

SEWAGE-SLUDGE DUMPING IN THE NEW YORK BIGHT APEX: A COMPARISON WITH OTHER PROPOSED OCEAN DUMPSITES,
National Oceanic and Atmospheric Administration, Stony Brook, NY. Office of Sea Grant.
R. L. Swanson, M. A. Champ, T. O'Connor, P. K. Park, and J. O'Connor.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 461-488, 4 fig, 75 ref.

Descriptors: *Coastal waters, *Ocean dumping, *Waste disposal, *Wastewater disposal, *New York Bight, *Legal aspects, Public policy, Regulations, Sludge.

In 1977, the Marine Protection, Research, and Sanctuaries Act, Public Law 92-532, was amended so that ocean dumping of harmful sewage sludge would not be allowed after 31 December 1981. Harmful sewage sludge is defined in the act as sludge that reasonably degrades the marine environment. The U.S. Environmental Protection Agency (EPA) interpreted this requirement to ban the dumping of all sewage sludge. Recently, however, the U.S. District Court for the southern District of New York ruled in City of New York v. Environmental Protection Agency that the EPA's conclusive presumption that sewaage sludge that is deemed harmful to the marine environment pursuant to EPA regulations will unreasonably degrade the environment is arbitrary and capricious and inconsistent with the act. Two ocean dumping sites have been suggested as alternatives to the New York Bight Apex site. These sites are a continental shelf site and a deepwater site seaward of the shelf break. After examining the various factors of sewage-sludge dumping at each of the three sites, continued use of the existing apex site is recommended until a regional waste disposal management plan can be developed. Implementing either alternative by itself will yield little improvement in the water quality of the New York Bight. If there were significant control of other contaminant input to the Bight, the deepwater site would be recommended. (See also W87-07729) (Author's abstract)
W87-07748

FUTURE STRATEGIES FOR NEARSHORE WASTE DISPOSAL,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
J. M. Capuzzo, W. V. Burt, I. W. Duedall, D. R. Kester, and P. K. Park.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 491-512, 2 fig, 4 tab, 35 ref.

Descriptors: *Coastal waters, *Waste disposal, *Ocean dumping, *Future planning, Environmental quality, Legal aspects, Regulations, Water pollution control, Path of pollutants.

Nearshore environments receive anthropogenic wastes from ocean dumping activities, pipeline discharges, atmospheric fallout, riverine input, and other nonpoint pollution sources. These environments are valuable as natural resources and are important ecological systems. In the past, in the United States, little attention was given to management aspects, and several laws now in force assign three disposal media (land, sea, and air) to different governmental agencies. A better method for considering the regulation of wastes would be the use of an integrated approach. Management of waste disposal in nearshore environments should consider a set of site-selection criteria dealing with physical, geochemical, sedimentary, and biological aspects of the ocean. Disposal systems and the waste discharges should be selected or designed to maximize dispersion of the wastes. Models can be developed to determine the residence time of some wastes in the ocean. Synthetic organic compounds and pathogens are two classes of contaminants requiring careful control, since their long-term effects are unknown. Point-source control, recycling, and development of substitute technologies are all effective measures that will decrease the amount of waste produced. The use of the ocean for waste disposal will require more research to determine the transport, sedimentation, chemical kinetics, association of organic material with solid particles, bioavailability, and effects of contaminants on populations and communities. (See also W87-07729) (Author's abstract)
W87-07749

GEOHYDROLOGIC FACTORS AND CURRENT CONCEPTS RELEVANT TO CHARACTERIZATION OF A POTENTIAL NUCLEAR WASTE REPOSITORY SITE IN COLUMBIA RIVER BASALT, HANFORD SITE, WASHINGTON,
Atomics International Div., Richland, WA. Rockwell Hanford Operations.
For primary bibliographic entry see Field 2F.
W87-07750

ORGANIC COMPLEXANT-ENHANCED MOBILITY OF TOXIC ELEMENTS IN LOW-LEVEL WASTES: QUARTERLY PROGRESS REPORT, JANUARY-MARCH 1984,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W87-07751

METHODS FOR DETERMINING THE MECHANICAL INTEGRITY OF CLASS II INJECTION WELLS,
Robert S. Kerr Environmental Research Lab., Ada, OK. Ground Water Research Branch.
For primary bibliographic entry see Field 8B.
W87-07783

EFFECT OF EXCESS FEEDLOT MANURE ON CHEMICAL CONSTITUENTS OF SOIL UNDER NONIRRIGATED AND IRRIGATED MANAGEMENT,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. F. Dormaar, and T. G. Sommerfeldt.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 2, p 303-313, May 1986. 4 tab, 28 ref.

Descriptors: *Waste disposal, *Water pollution effects, *Manure, *Fertilizers, *Irrigation effects, *Soil chemical properties, *Feedlot wastes, *Soil amendments, *Sugars, Mineralization, Farm wastes, Barn wastewater, Animal wastes, Irrigation, Soil types, Organic matter, Enzymes, Phosphorus, Soil moisture, Soil chemistry, Soil horizons, Soil profiles, Carbon, Agronomy.

A long-term field experiment was initiated in 1973 to determine the safe loading capacity of a Lethbridge loam (Dark Brown Chernozemic) with feedlot manure. The effect of 10 yr of feedlot manure loading was examined by analyzing a number of inorganic and organic matter constituents of the Ap horizon. Although soil C, P, and enzyme activities increased as feedlot manure additions to the soil increased, these increases diminished at triple the recommended loading regimes. Phosphatase activity was checked by increased labile phosphorus levels. Levels of adenosine 5'-triphosphate increased but fluctuated with time under various moisture regimes. The C:N ratios, percent monosaccharide C of total soil C, and the ratio of deoxyhexoses to pentoses remained constant while the percentage of manure C retained decreased as feedlot manure loading increased. The distribution between pentoses and hexoses was strongly affected by feedlot manure levels, while the deoxyhexose percentage of the sum of the eight monosaccharides determined remained about the same. Feedlot manure additions, at triple the recommended level, increased the labile P as a percentage of total soil P to around 50%. It is concluded that, although mineralization did not keep pace with the quantities applied, the presence of undecomposed manure did not seem to have harmful agronomic effects. (Author's abstract)
W87-07911

CONSISTENT DEWATERING MAKES SLUDGE PREFERRED BOILER FUEL,
J. Makansi.
Power POWEAD, Vol. 130, No. 12, p 83-84, December 1986. 1 fig.

Descriptors: *Sludge combustion, *Screw presses, *Sludge drying, *Sludge utilization, *Process control, *Fuel, Technology, Sludge, Sludge conditioning.

A consistent level of sludge dewatering is important to minimize the impact on boiler operation and maintenance when burning sludge continuously in an existing boiler not originally designed for sludge combustion. Champion International Corp. is achieving a consistently high level of sludge dewatering at its Sheldon, TX newsprint mill, using an improved screw press. Since installation of the machine in January 1986, the plant has been producing a sludge that is 45-50% solids; site engineers believe they can get 48% on a consistent basis. This dewatered sludge now provides nearly 50% of the thermal input for an existing multi-fuel boiler that usually fires bark and some natural gas to even out load swings. The design and operation of the press is described. Steam injection is used about 3-4 hours per day to condition the sludge. Efficiency when burning bark and sludge is 63.5%. Payback on the project has been evaluated at one year. Since this installation, a Westvaco Co. paper mill in Charleston, SC has installed a similar screw press. (Author's abstract)
W87-07925

ESTIMATION OF DILUTION IN BUOYANT EFFLUENTS DISCHARGED INTO A CURRENT,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
J. J. Sharp, and E. Moore.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 83, Part 2, p 181-196, March 1987. 8 fig, 2 tab, 27 ref, append.

Descriptors: *Mixing, *Dispersion, *Path of pollutants, *Currents, *Hydrodynamics, *Dilution, *Buoyancy, *Effluents, *Outfall sewers, *Model studies, *Mathematical equations, *Comparison studies, Prediction, Field tests, Jets, Design standards.

The methods available for estimating dilution from a submerged outfall discharging a single, round, buoyant jet into a current are considered. Three equations recently presented in the UK are compared with one mathematical model representative of those used by designers in North America. A comparison of the various predicted dilution values is given and these are discussed in the light of published field data. (Author's abstract)
W87-08077

AIRBORNE MULTISPECTRAL SCANNER DATA FOR ESTIMATION OF DYE DISPERSION FROM SEA OUTFALLS,
Sheffield Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W87-08078

SEA WATER INTRUSION AND PURGING IN MULTI-PORT SEA OUTFALLS,
For primary bibliographic entry see Field 8B.
W87-08079

SEWAGE EFFLUENT - A WATER RESOURCE,
For primary bibliographic entry see Field 3C.
W87-08088

ENVIRONMENT AND SOLID WASTES: CHARACTERIZATION, TREATMENT, AND DISPOSAL.
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5D.
W87-08166

EFFECT OF RCRA ON THE CHEMICAL INDUSTRY,
Chemical Manufacturers Association, Washington, DC.
For primary bibliographic entry see Field 5G.
W87-08167

MUNICIPAL SLUDGE MANAGEMENT,
Metropolitan Sanitary District of Greater Chicago, IL.
D. R. Zenz, and C. Lue-Hing.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 13-24, 8 tab, 7 ref.

Descriptors: *Municipal wastes, *Waste management, *Sludge, Sludge disposal, Incineration, Land disposal, Ocean dumping, Cost analysis, Sludge lagoons, Lagoons.

Municipal sludge utilization and disposal is one of the most difficult problems facing municipalities today. In the United States, about 18,000 dry tons/day of municipal sludge is projected to be produced by 1985. Municipal sludge is normally handled by incineration, land application, ocean disposal, or landfilling. Incineration may not be a feasible alternative in the future unless methods can be found to keep auxiliary fuel requirements to a minimum. Land application has become increasingly popular with municipalities, because the fertilizer value of the sludge can be used. Although ocean disposal offers a simple, low-cost solution to municipal sludge agencies, its use remains uncertain until the U.S. Environmental Protection Agency (EPA) issues regulations or appeals a recent federal court ruling that found ocean disposal cannot be completely terminated by an EPA mandate. Landfilling can be a low-cost disposal method if land space is available in urban areas. Most municipal sludge can be disposed of in non-hazardous landfills becuase they would not be classified as hazardous under the EPA extraction procedure toxicity test. A survey of municipal sludge practices revealed five sludge management options in order of preference: (1) sale and give away, (2) ocean disposal, (3) land-filling, (4) land application, and (5) lagooning. (See also W87-08166) (Author's abstract)
W87-08168

COAL-FIRED POWER PLANT WASTE MANAGEMENT,
Electric Power Research Inst., Palo Alto, CA.
J. S. Maulbetsch, and I. P. Murarka.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 25-35, 3 tab, 17 ref.

Descriptors: *Powerplants, *Waste management, *Waste disposal, *Environmental effects, Solid wastes, Sludge, Land disposal, Path of pollutants, Groundwater pollution.

Coal-fired power plants produced 45% of the 2.2 times 10 to the 12th power kWh of electricity generated in 1978; this is expected to increase to 49% of a projected 3.5 times 10 to the 12th power kWh by 1988, a 77% increase. Over 63 million tons of solid wastes were produced (primarily ash and scrubber sludge) in 1979. These wastes are disposed of on land; potential environmental effects are airborne (fugitive emissions) and waterborne (runoff to surface waters; leachate and permeate to groundwater). This chapter summarizes briefly what is known and what needs to be known about the wastes and their characteristics; what constituents enter the environment from disposal facilities; where the wastes go and at what rate they arrive; whether potential harm exists from their eventual distribution; and what the methods and costs of treating, disposing of, and containing the wastes may be. A brief summary of utility disposal practices and current regulatory issues (environmental assessment, ecological effect, and human health effects) is given, and data and sources of data are provided. The choice of the appropriate waste management techniques and the associated cost depend on the degree of containment deemed necessary to provide adequate protection for the environment, primarily groundwater aquifers. The techniques for any specified level of containment are available at a price. The greatest uncertainty lies in our ability to predict which contaminants leave a disposal facility, at what rate they enter the groundwater, and where they go. Development of validated predictive models or conducting a sufficient number of monitoring programs to reduce that uncertainty is a formidable task. (See also W87-08166) (Lantz-PTT)
W87-08169

CEGB EXPERIENCE IN FUEL ASH DISPOSAL,
Central Electricity Generating Board, Nottingham (England). Midlands Region.
J. Brown.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 37-52, 1 fig, 4 tab, 7 ref.

Descriptors: *Central Electricity Generating Board, *Fuel ash, *Waste disposal, *Environmental effects, Landfills, Land disposal, Land reclamation, Groundwater pollution.

The Central Electricity Generating Board (CEGB) coal-fired power stations produce about 12,000,000 tons(t) of ash per year. After sales for commercial use, about 7,000,000 t are left for disposal to landfill sites. The environmental aspects of CEGB experience in this area are described. In the handling of ash in wet disposal systems, the discharge of water after use to the appropriate water course is governed by consents set by water authorities. With good design and operation of lagoons, the limits are achieved with reasonable margins. The potential problem of dust nuisance as the ash dries out can likewise be adequately controlled by good practice. The possible impact of ash dispsoal on groundwaters is governed by several factors - the ash itself, the size of the area to be reclaimed, the rainfall pattern, and the local geohydrology, including the size and rate of recharge of the aquifer itself. Each potential site needs to be considered on its merits. The basic CEGB approach is discussed; it requires the combination of laboratory studies of percolate quality with hydrogeological assessments to evaluate potential risk, if any. The successful restoration of various derelict or low-grade sites to agricultural use has been achieved with obvious beneficial effects on visual amenity. Reclamation with pulverized fuel ash (PFA) can usually be achieved with minimal application of topsoil, which has obvious economic benefits. In the early stages, attention to the nutrient status of the ash is required, and appropriate selection of crops is practiced until the site is weathered and established. In 25 years of experience with such reclamation practice, no adverse effects have been observed in man or animals from trace element uptake in growing crops on PFA, and this is consistent with the associated scientific studies in this area. (See also W87-08166) (Author's abstract)
W87-08170

WASTES FROM EMERGING ENERGY TECHNOLOGIES,
UKAEA Atomic Energy Research Establishment, Harwell (England). Waste Research Unit.
L. Kronenberger.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 53-62, 5 fig.

Descriptors: *Waste disposal, *Industrial wastes, *Powerplants, Solid wastes, Waste management, Coal, Oil shale, Gasification, Mine wastes.

When synthetic fuels are produced by oil shale retorting and coal gasification or liquefaction, large quantities of solid waste materials must be handled and disposed of in an environmentally acceptable manner. Although solid waste management plans have been prepared and, in some cases, permits have been obtained, no commercial-scale synthetic fuels facilities are operating in this country today. Howver, many major components of these facilities are similar to other commercial operations. For example, a coal conversion project would include mining, steam generation, and gas and liquid processing steps not unlike those in petroleum refining and chemicals manufacture. A commercial 50,000-bbl/d shale oil project involves mining and retorting of about 70,000 t/d oil shale. After recovery of the kerogen, the spent shale would be conveyed to a suitable surface disposal site and compacted in place. Over a 20- and 30-year project life, the accumulation would cover hundreds of acres to depths of several hundred feet or more. Important environmental concerns include pile stability, runoff water quality, and degree of leaching before and after revegetation has been completed. Lurgi coal gasification technology is being studied for possible application to East Texas lignite. Large quantities of solids to be handled include boiler fly ash, boiler bottom ash, and gasifier ash. The project would be supplied by a lignite surface mine. Some wastes may have characteristics that would allow disposal in the mine before reclamation. (See also W87-08166) (Author's abstract)
W87-08171

TESTING METHODS FOR HAZARDOUS WASTES PRIOR TO LANDFILL DISPOSAL,
UKAEA Atomic Energy Research Establishment, Harwell (England). Waste Research Unit.
D. C. Wilson, and P. J. Young.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983 p 69-81, 4 fig, 9 ref.

Descriptors: *Hazardous wastes, *Landfills, *Waste disposal, Leaching, Field tests, Municipal wastes, Pesticides.

For several years, the Waste Research Unit of the Harwell Laboratory has been developing testing methods on behalf of the United Kingdom's Department of Environment. The goal was to assess the suitability of a specific hazardous waste for disposal at a particular landfill site. The approach is based on measuring the reduction of contaminant concentrations in leachate caused by one or more specific mechanisms. The leaching test devised here is simple and is based on repetitive extraction using a very high solid-to-liquid ratio, defined in such a way as to allow correlation with expected field behavior over time. Validation experiments using large laboratory columns to simulate leachate generation in a landfill have yielded surprising results. These experiments demonstrate the need to verify any small-scale test by comparison with field, or simulated field, experiments. In addition to specific measurements of one attentuation mechanism in isolation, the unit is currently developing test methods to simulate codisposal of hazardous with municipal wastes on a laboratory scale. To illustrate the techniques, preliminary results will be presented from a series of large-column experiments containing a 'sandwich filling' of four differ-

ent pesticides wastes. (See also W87-08166) (Author's abstract)
W87-08172

DEVELOPMENT OF MULTIMEDIA ENVIRONMENTAL GOALS FOR POLLUTANTS IN SOLID WASTES AND LEACHATES,
Research Triangle Inst., Research Triangle Park, NC.
G. L. Kingsbury, K. L. Mack, and S. M. Harkins.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 83-96, 4 tab, 11 ref.

Descriptors: *Leachates, *Solid wastes, *Waste disposal, *Path of pollutants, Water pollution, Environmental effects, Soil contamination, Groundwater pollution, Leaching, Regulations.

Multimedia environmental goals (MEGs) are concentration goals for specific pollutants in air, water, and soil. They have been developed for use in environmental assessments to identify and rank chemicals of concern in discharge streams. MEGs are being used extensively by the Environmental Protection Agency and others to aid in data interpretation. A methodology to generate MEGs from available dat was introduced and demonstrated in 1977. To date, goals for more than 600 chemical pollutants have been specified. Compounds addressed by MEGs are assigned to categories on the basis of their chemical functional groups. MEGs for solid waste contaminants are derived from water goals based on the assumption that the significant exposure routes will involve leaching of pollutants into ground or surface waters. Water MEGs reflect existing federal guidelines, potential acute and chronic effects (indicated by human and/or animal data), genotoxic potential, and aquatic toxicity. Applications and limitations of the MEGs are discussed, and revisions to the methodology now under consideration are presented. (See also W87-08166) (Author's abstract)
W87-08173

FOOD CHAIN PATHWAYS FOR TOXIC METALS AND TOXIC ORGANICS IN WASTES,
Agricultural Research Service, Beltsville, MD. Biological Waste Management and Organic Resources Lab.
For primary bibliographic entry see Field 5B.
W87-08179

SIMULATION STUDY OF THE VOLATILIZATION OF POLYCHLORINATED BIPHENYLS FROM LANDFILL DISPOSAL SITES,
Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W87-08180

RESPONSIBLE LONG-TERM USE OF AGRICULTURAL AND URBAN LAND FOR SOLID WASTE DISPOSAL,
Ohio State Univ., Columbus. Dept. of Agronomy.
T. J. Logan, and R. H. Miller.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 259-272, 1 fig, 3 tab, 12 ref.

Descriptors: *Land disposal, *Solid wastes, *Waste disposal, *Urban areas, Disposal sites, Sludge, Wastewater disposal, Nitrogen, Phosphorus, Cadmium, Polychlorinated biphenyls.

Because the nation's agricultural soils constitute one of its most valuable resources, long-term productivity of such soils must be maintained or enhanced. At the same time, proper and responsible use of soils for disposal of certain solid waste materials can recycle valuable nutrients, improve the physical properties of soils, and provide a cost-effective method for waste disposal with financial benefits to the urban sector. Likewise, some solid wastes, primarily composted organic materials and fly ash, aid in reclamation of land disturbed or impaired by surface mining. These reclamation efforts may increase the land's agricultural productivity beyond its premining capability. Organic solid wastes can substitute, in the urban sector, for commercial products in landscaping (e.g., of highways, parks and homes). The long-term potential hazards of solid waste disposal on agricultural and urban land are from those waste constituents that will accumulate in soil and are not readily recycled through plants, primarily heavy metals and stable toxic organics. For domestic sewage sludges, garbage, and agricultural processing wastes, annual application rates that satisfy the nitrogen or phosphorus requirements of agricultural or horticultural crops (1-10 t/ha) will prevent accumulation of these materials, and regulations as presently formulated for cadium and polychlorinated biphenyls (PCB) can control total accumulation in a particular soil. Disposal of more contaminated solid wastes on land may require the use of dedicated sites with controlled drainage and more extensive monitoring. The waste disposal history of all sites should be maintained as guidance for long-term land use change. (See also W87-08166) (Author's abstract)
W87-08183

WHO IS RESPONSIBLE FOR THIS MESS - PUBLIC PERCEPTIONS OF THE WASTE MANAGEMENT ISSUE,
Environmental Action Foundation, Washington, DC.
L. A. Florence, and J. Sheldon.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 273-284, 15 ref.

Descriptors: *Waste management, *Public opinions, *Public policy, *Love Canal, *Surveys, *Waste disposal, Hazardous wastes, .

In the wake of Love Canal and reports of other tragic environmental problems, public concerns and fear in many communities have risen to near-hysterical levels. This concern has led to public distrust of the government agencies and industries involved in waste management. To assess public attitudes toward these agencies and industries and to measure public knowledge of waste management issues, a national survey was conducted. A questionnaire was mailed to 1000 environmentalists who belong to groups that work on hazardous waste. The general public was surveyed through telephone interviews. Preliminary results of this survey are presented, and literature and other surveys available on the subject are reviewed. Some interesting conclusions may be drawn from the results of the surveys reviewed in this report. Findings indicate that a relatively small percentage of the population is knowledgeable about hazardous waste issues that have received national attention. At first, hazardous waste management may appear to be a low-profile issue. Yet, public concern about hazardous waste is nearly as high as that for issues of undisputed importance such as inflation and crime. True, it is startling to learn that only 37% of nearby residents can give a correct or partly correct description of the incident at Love Canal. Two-thirds of nearby residents and 87% of environmentalists expressed personal concern about the effects of hazardous waste on their community and on their health. Although most of the public is at least aware of hazardous waste, efforts must be made to educate the public in this area. (See also W87-08166) (Lantz-PTT)
W87-08184

RISK ANALYSIS: SOLID WASTES FROM OIL SHALE AS AN EXAMPLE OF THE USE OF HEALTH EFFECTS AND ECOLOGICAL DATA FOR RISK ESTIMATION,
IWG Corp., San Diego, CA.
For primary bibliographic entry see Field 5C.
W87-08185

MONITORING OF SOLID WASTE DISPOSAL SITES: WHAT FACTORS ARE RELEVANT FOR ELECTRIC UTILITIES,
Little (Arthur D.), Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W87-08188

FIELD DATA COLLECTION AT ABANDONED WASTE DISPOSAL SITES: PROBLEMS IN DATA GATHERING,
Ethurs, McLean, VA.
For primary bibliographic entry see Field 7B.
W87-08190

INCINERATION IN EUROPEAN SOLID WASTE MANAGEMENT,
Aalborg Universitetscenter (Denmark). Environmental Engineering Lab.
J. A. Hansen.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 387-408, 4 fig, 4 tab, 7 ref.

Descriptors: *Waste management, *Incineration, *Solid wastes, *Denmark, *Norway, *Surveys, Cost analysis, Landfills, Data interpretation, Economic aspects.

Through a limited letter survey, the processing of municipal solid waste (MSW) was assessed for Switzerland, West Germany, Sweden, Norway, and Denmark. Incineration was the dominating technology, whereas landfilling without processing is decreasing. Whether this is a general European tendency cannot be judged from the data gathered. Incineration was evaluated in terms of resource recovery, environment, and economy. Although this study was based mainly on Danish experiences, some more-general observations are presented. Incineration with heat recovery and simultaneous materials recovery by source separation seems compatible. A few projects on central separation proposed in Norway and Denmark suggest incineration of residues amounting to about 60% of solid waste sorted. Environmental impacts are poorly known, but good methodology and equipment are available; efficient training of personnel and skilled operation may significantly improve environmental control. At European energy prices, incinerators could be operated at zero cost where district heating is feasible - at least in temperate climates. Materials recovery from MSW may require a more thorough examination than presented thus far. A simple economical comparative evaluation would not suffice, but would only show that, on a marginal price basis, paper recovery is inferior to burning at an existing incinerator. (See also W87-08166) (Author's abstract)
W87-08192

OPTIMIZATION OF SOLID WASTE SEPARATING SYSTEMS,
Forest Hills Gardens, NY.
For primary bibliographic entry see Field 5D.
W87-08193

INCINERATION: WHAT ROLE,
California Governor's Office of Appropriate Technology, Sacramento.
H. M. Freeman.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 425-434, 1 tab, 3 ref.

Descriptors: *Incineration, *Hazardous wastes, *Waste disposal, Landfills, Organic wastes, Trace levels, Waste management.

Hazardous waste generation rates appear to be increasing, and disposal of these wastes in landfills is becoming increasingly unpopular. Other more environmentally acceptable treatment and disposal options are needed, one of which is incineration.

The advantages of incineration are that it detoxifies organic wastes; it greatly reduces the volume of wastes that must be ultimately placed in landfills; and it eliminates any long-term liability for the waste. The disadvantages are that it is expensive relative to current disposal costs; it produces emissions possibly containing trace levels of hazardous constituents; and it provides for only limited recycling of the materials contained in the waste streams. Explored here is the state of the art of using incineration to destroy hazardous wastes, and evaluated is the role of incineration in the nation's approach to hazardous waste management. (See also W87-08166) (Author's abstract)
W87-08194

REMEDIAL ACTIONS AT SOLID WASTE LANDFILLS,
Wehran Engineering Corp., Middletown, NY.
R. D. Mutch, and W. J. Siok.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 435-448, 1 fig, 1 tab.

Descriptors: *Waste disposal, *Landfills, *Solid wastes, Hazardous wastes, Disposal sites, Diversion, Drainage systems, Capping.

Remedial or mitigative action programs at abandoned hazardous waste disposal sites encompass a wide spectrum of specific remedial measures (i.e., suirface runoff diversion, diversion of groundwater inflow, facilitated drainage of the landfill surface, and landfill capping). Past experiences have clearly demonstrated the site-specificity of remedial measures. Because no two sites are alike in their hydrogeologic environment or their impact on the environment, no two site-restoration projects are identical. Judgement must be exercised in evaluating the environmental impacts and weighing these impacts against the cost-effectiveness of various remedial action alternatives. In most cases, the overall site restoration will encompass several individual remedial measures, each addressing one or more mechanisms of leachate generation or migration. (See also W87-08166) (Author's abstract)
W87-08195

LAND TREATMENT OF HAZARDOUS WASTES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 5D.
W87-08196

SETTING PRIORITIES IN HAZARDOUS WASTE MANAGEMENT,
Technical Information Project, Inc., Washington, DC.
A. H. Purcell.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 475-482, 3 ref.

Descriptors: *Hazardous wastes, *Waste management, *Priorities, Waste disposal, Toxicity, Wastes, Recycling.

Management of hazardous wastes covers a wide spectrum of activities and disciplines: source reduction, materials handling, toxicity evaluation, transportation, use, disposal, storage, repositioning and recycling. Each activity encompasses many considerations and requires strict priority setting to optimize the effectiveness of the activity in overall management programs. A few priority areas that are of immediate attention in the management of hazardous wastes are identified. These are: (1) source flow and processing and manufacturing; (2) use; and (3) disposal. Priority, by its very definition, connotes an urgency. The fact that several high-priority areas characterize the management of hazardous wastes is indicative of the set of urgencies that surround hazardous and toxic waste problems. The priority areas outlined will require cooperation and interaction among several disciplines if they are to be met. For example, source reduction is as much a management and policy problem as a technological one. Compensation, at first glance, seems to be of only a legal nature, but it actually requires significant scientific input to have a meaningful basis, and competent administrative effort to put systems into practice. Similarly, other priority areas are of equally interdisciplinary natures. With resources limited and time running short, it is becoming ever clearer that these few areas must receive greater attention in programs to manage toxic and hazardous substances. None of these areas is small or simple to tackle, but with proper efforts, each can be more effectively addressed. (See also W87-08166) (Lantz-PTT)
W87-08197

EVALUATION OF SEPTIC TANK SYSTEM EFFECTS ON GROUND WATER QUALITY,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 5B.
W87-08207

PRACTICAL MANUAL FOR DETERMINING SETTLING RATES OF OCEAN DISPOSED SEWAGE SLUDGE,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
D. A. Tennant, S. L. Walker, J. W. Lavelle, and E. T. Baker.
NOAA Technical Memorandum ERL PMEL-69, February 1987. 29 p, 6 fig, 11 ref.

Descriptors: *Ocean dumping, *Wastewater disposal, *Path of pollutants, *Settling velocity, *California, *Los Angeles, *Sludge disposal, Sludge, Measuring instruments, Chemical analysis.

For measurement of the size and settling velocity characteristics of sewage sludge particles in seawater, three measurement sequences are required for complete characterization. They can be performed separately according to the goals or needs of the user. The first measurement sequence provides percent total solids and some size characterization of the material. This involves standard techniques and the work can be accomplished quickly and easily. The second set of measurements results in a settling velocity distribution of the larger (coarser) fraction of the sludge. These procedures require slightly more time and skill, but they are standard and straightforward methods. The third sequence of measurements is intended to provide a settling velocity distribution for the fine-fraction of sludge particulates. These measurements are not standard and require considerable effort, special apparatus, and the availability of a Coulter Counter or similar electronic particle counter. This manual goes through the procedures of analyzing sludges subject to ocean disposal in a step-by-step fashion, detailing procedures developed and tested in the laboratory. The end result of a sludge analysis using these three separate measuring sequences will be the determination of solid content, bulk size fractionation, and settling spectrum of both coarse and fine fractions of sludges as disposed in the ocean. Examples are taken from an analysis of sludges from the Hyperion outfall in Los Angeles. (Lantz-PTT)
W87-08227

ANALYSIS OF PUMPING TESTS OF THE CULEBRA DOLOMITE CONDUCTED AT THE H-3 HYDROPAD AT THE WASTE ISOLATION PILOT PLANT (WIPP) SITE,
Sandia National Labs., Albuquerque, NM.
For primary bibliographic entry see Field 2F.
W87-08243

EVALUATION OF MICROEXTRACTION/CAPILLARY COLUMN GAS CHROMOTOGRAPHY FOR MONITORING INDUSTRIAL OUTFALLS,
Occidental Chemical Corp., Grand Island, NY. Research Center.
For primary bibliographic entry see Field 5A.
W87-08272

DISTRIBUTION OF IRON-OXIDIZING BACTERIA IN THE NORDIC URANIUM TAILINGS DEPOSIT, ELLIOT LAKE, ONTARIO, CANADA,
Canada Centre for Mineral and Energy Technology, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W87-08299

O & M DREDGING EXPERIENCE AS RELATED TO CHANNEL DEEPENING FOR COAL PORTS,
Army Engineer District, Norfolk, VA.
R. G. Vann.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 192-199.

Descriptors: *Dredging, *Water resources development, *Water management, Water quality control, Resources development, Aquatic environment, Environmental effects, Channels, Pollutants.

The Norfolk District Corps of Engineers innovative channel design, dredging techniques, disposal operations, and environmental coordination which favorably impact on water quality are discussed. Innovative channel design for coal export shipping lanes, which lead to minimal dredging, are described. A dredging demonstration with nationwide application for the removal of contaminated sediments is discussed. The management of dredged material disposal sites is also discussed. Beneficial usages of dredged material, such as marsh creation, beach nourishment, nesting habitat for water fowl and improved oyster bed substrate, are being undertaken by the district. (See also W87-08365) (Halterman-PTT)
W87-08385

CHLORINATED DIOXINS AND DIBENZOFURANS IN PERSPECTIVE.
For primary bibliographic entry see Field 5A.
W87-08471

SAMPLING STRATEGY FOR REMEDIAL ACTION AT HAZARDOUS WASTE SITES: CLEANUP OF SOIL CONTAMINATED BY TETRACHLORODIBENZO-P-DIOXIN,
IT Enviroscience, Martinez, CA.
J. H. Exner, W. D. Keffer, R. O. Gilbert, and R. R. Kinnison.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 139-155, 4 fig, 3 tab, 13 ref.

Descriptors: *Hazardous materials, *Sampling strategies, *Soil contamination, *Cleanup operations, *Dioxin, Cleanup, Pollutants, Soil tests, Toxins, Missouri, Mathematical equations, Mathematical studies, Chlorinated hydrocarbons.

A sampling strategy for verifying to a desired confidence that a previously contaminated area meets criteria of cleanliness is presented. The approach is illustrated for the proposed excavation of soil contaminated by 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin). The case study which involved soil in Missouri which had been contaminated when dioxin-containing waste oil was sprayed for dust control was detailed with the important cleanup decisions, methods of dealing with 'hot spots' and associated health risks included along with the sampling strategy. The general strategy used can be applied to the cleanup of any materials that are toxic and difficult to analyze. (See also W87-08471) (Wood-PTT)
W87-08472

DESTRUCTION OF DIOXIN-CONTAINING WASTES IN A MOBILE INCINERATION SYSTEM,
Environmental Protection Agency, Kansas City, MO. Region VII.

R. D. Kleopfer, R. H. Hazel, F. J. Freestone, and P. E. des Rosiers.
IN: Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc., Chelsea, MI. 1986. p 511-518, 2 fig, 5 tab, 11 ref.

Descriptors: *Waste disposal, *Incineration, *Industrial wastes, *Dioxin, *Path of pollutants, Missouri, Soil contamination, Hazardous materials, Toxins, Evaluation, Chlorinated hydrocarbons, Detoxification, Decontamination.

Over 40 sites contaminated at levels above 1.0 part per billion by 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) were identified in the state of Missouri. Most of these sites were identified more than ten years after their contamination as a result of the waste disposal practices of an industrial producer of hexachlorophene. The high contamination levels found attest to the stability and persistance of 2,3,7,8-TCDD in the environment. A transportable rotary kiln incineration system was proposed as a method of remedial action. A description of the system and the results of its evaluation were presented. During the trials, 1750 gallons of chlorinated dioxin-contaminated liquid and more than 40 tons of chlorinated dioxin-contaminated soils were burned in the incinerator. These materials contained up to 357 ppm of the highly toxic 2,3,7,8-TCDD isomer and in each case its destruction and removal efficiency was shown to be greater than 99.9999%. 2,3,7,8-TCDD was not detected either in the stack gas or in any of the other major waste streams including the kiln ash, the cleanable high-efficiency air filter, and the wastewater. It was concluded that the rotary kiln/secondary combustion technology can be used safely and effectively to detoxify both solid and liquid wastes contaminated by 2,3,7,8-TCDD. (See also W87-08471) (Wood-PTT)
W87-08490

EFFECT OF THE COEFFICIENTS OF DISCHARGE ON CILIATE POPULATIONS OF A RUNNING WATER CONTAMINATED BY MUNICIPAL WASTEWATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 2H.
W87-08513

EFFECT OF URBANIZATION ON THE GROUNDWATER OF LIMESTONE ISLANDS: AN ANALYSIS OF THE BERMUDA CASE,
Public Works Dept., Hamilton (Bermuda).
For primary bibliographic entry see Field 5B.
W87-08532

WASTEWATER DISPOSAL IN THE RIJEKA REGION,
Institute for Physical Planning and the Protection of the Environment, Istarska (Yugoslavia).
M. I. Mastrovic, and G. D. Silovic.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 77-84, 1986. 3 tab, 4 ref.

Descriptors: *Water quality control, *Wastewater disposal, *Wastewater, *Coastal waters, Rijeka region, Adriatic Sea, Pollutants, Water pollution effects, Tourism, Wastewater treatment, Municipal wastewater, Industrial wastewater.

The need for detailed analysis of wastewaters and their impact on the environment in physical plans for urban/tourist coastal areas is emphasized as a significant contribution to environmentally sound development, especially the development of tourism in these areas. An analysis of this kind, prepared as part of the Regional Physical Plan for the Rijeka Region to the Year 2000, is described. (The Rijeka Region is a major part of the Yugoslav Upper Adriatic.) The existing situation regarding sewerage systems, sewage treatment methods and disposal methods of the communes of the Region is presented. The quantities of wastewaters generated by the residential and tourist populations and by industry are given (by sub-regions) as calculated in 1981 and as estimated for the year 2000. A survey was made of the impact of wastewater on receiving rivers and coastal waters, and the quality of the receiving waters is given, in grades as compared with those prescribed by the Yugoslav legal regulations. Based on urban development concepts, and on the estimated wastewater quantities, alternative forecasts are made of the future impact of wastewater on coastal waters. General guidelines are presented for the provision of adequate sewage disposal facilities in order to achieve the optimum situation. (Author's abstract)
W87-08547

LEGAL AND ADMINISTRATIVE ASPECTS OF THE TREATMENT AND DISCHARGE OF INDUSTRIAL WASTEWATERS IN THE MEDITERRANEAN,
World Health Organization, Athens (Greece). Coordinating Unit for the Mediterranean Action Plan.
For primary bibliographic entry see Field 5G.
W87-08559

PLANNING THE DISPOSAL OF WASTE WATERS FOR SMALL TOURIST RESORTS IN DALMATIA,
Split Univ. (Yugoslavia). Faculty of Civil Engineering Sciences.
J. Margeta.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 243-256, 1986. 3 fig, 1 tab, 7 ref.

Descriptors: *Wastewater disposal, *Water quality control, *Water pollution control, *Coastal waters, *Dalmatia, Yugoslavia, Wastewater, Seasonal variation, Tourism, Wastewater pollution, Wastewater management, Water quality, Economic aspects, Wastewater treatment.

Small tourist resorts in Dalmatia have some specific problems concerning wastewater disposal with a special emphasis on the significant daily and yearly oscillations of wastewater quantities. On the other hand, the conditions necessary for solving these problems in Yugoslavia are not very favorable when considering either the financial or the technological aspect. Taking into account the importance of the sea water quality along the coast for the economic development of these resorts as well as the difficulties arising when solving this problem, the objective was to find the optimal solution. Some alternatives were presented as well as the method used for selection of the optimal solution. A ranking procedure is used to develop the alternative solutions and describe their application. The solution used most frequently for the disposal of wastewater, i.e. the 'Treatment plant-submarine discharge', was analyzed. The ranking of the alternative solutions and the selection of the optimal one according to the current practices in Dalmatia were presented. (Author's abstract)
W87-08562

PRINCIPLES AND CRITERIA FOR THE PROTECTION OF WATER AGAINST POLLUTION FROM HOSPITALS IN THE MEDITERRANEAN COASTAL REGION,
Institute of Public Health, Zagreb (Yugoslavia).
For primary bibliographic entry see Field 5B.
W87-08564

FROM COASTAL WATER POLLUTION CONTROL TO THE RECLAMATION OF SEWAGE,
J. C. Degaetano, and H. J. Mallia.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 279-292, 1986. 9 fig, 2 ref.

Descriptors: *Wastewater disposal, *Wastewater pollution, *Coastal waters, *Wastewater renovation, *Water reuse, *Impaired water use, Water pollution, Wastewater, Water pollution control, Seashores, Outfall, Submarine outfall, Mediterranean Sea.

Following Master Plan studies by the World Health Organization and other consultant sanitary engineers on waste disposal, the Maltese Government implemented in successive stages projects aimed at the abatement of the pollution of bays and seaside resorts around the island, culminating in the laying of a submarine outfall to discharge approximately 90% of the sewage produced on the island. After thus cleaning the blue coastal waters, sewage has been reclaimed for the beneficial use by the farming community. Three projects and the related environmental, public health, social, economic, and agricultural benefits were described. Malta has actively participated in projects and conventions aimed at controlling coastal pollution from land-based sources in order to halt the deterioration of the Mediterranean Sea. (Wood-PTT)
W87-08566

5F. Water Treatment and Quality Alteration

SUSCEPTIBILITY OF MEMBERS OF THE FAMILY LEGIONELLACEAE TO THERMAL STRESS: IMPLICATIONS FOR HEAT ERADICATION METHODS IN WATER DISTRIBUTION SYSTEMS,
Veterans Administration Medical Center, Pittsburgh, PA. Special Pathogens Section.
J. E. Stout, M. G. Best, and V. L. Yu.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 2, p 396-399, August 1986. 1 fig, 1 tab, 17 ref.

Descriptors: *Legionella, *Thermal stress, *Water treatment, *Water conveyance, *Sterilization, *Public health, *Temperature effects, Stress, Bacteria, Pathogenic bacteria, Hospitals.

The feasibility of heat inactivation as an eradication method applicable to all members of the family Legionellaceae was tested using 75 isolates representing 19 members of the family. The ranges of death times at 60, 70, and 80 C were 1.3-10.6, 0.7-2.6, and 0.3-0.7 min, respectively. It is concluded that heat eradication should be effective against all members of the Legionellaceae. The heat resistance of Legionella pneumophila serogroup 1, the most common pathogen in the family, was assessed in greater detail, using conditions found in hospital water systems. The thermal stabilities of two environmental strains of this serogroup were found to be virtually unaffected when heat resistance was determined in broth, water, or water containing particulates. (Author's abstract)
W87-07600

EVALUATION OF A TANGENTIAL-FLOW MULTIPLE-FILTER TECHNIQUE FOR DETECTION OF GIARDIA LAMBLIA CYSTS IN WATER,
British Columbia Univ., Vancouver. Provincial Labs.
For primary bibliographic entry see Field 5A.
W87-07601

SURFACE WATER TREATMENT FOR COMMUNITIES IN DEVELOPING COUNTRIES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
C. R. Schulz, and D. A. Okun.
John Wiley and Sons, New York, New York. 1984. 299 p.

Descriptors: *Water treatment, *Surface water, *Developing countries, Pretreatment, Chemical treatment, Hydraulic machinery, Settling basins, Filtration, Sand filters, Water treatment facilities.

Engineers educated in the industrialized world are taught to use technologies that are characterized as 'capital-intensive'. Their texts and references focus on the latest 'high' technology, which is marketed locally and supported with maintenance services and stocks of spare parts. In developing countries, these maintenance services and spare parts are often difficult or impossible to obtain. When personnel do become trained to provide maintenance services, their knowledge and skills are increased to a point where the private sector, or other higher-paying jobs, entice them away. Engineers educated in the industrialized countries, furthermore, are not familiar with technologies that minimize the need for support facilities and highly skilled technicians. Some of these technologies are identified in this text. Information concerning their

performance is provided where available. The following technologies are judged to be of merit in considering options for surface water treatment in communities in developing countries. Planners, managers, and engineers would do well to see that these technologies are among those that are evaluated before selection of design approaches: (1) pretreatment, which refers to the 'roughing' treatment processes such as plain sedimentation, storage, and roughing filtration, which are designed to remove the larger-sized and settleable material before the water reaches the initial treatment units; (2) chemicals, commonly necessary in water treatment include a coagulant, disinfectants, and something for pH control; (3) chemical feeders; (4) hydraulic rapid mixers, units which are located at the beginning of the plant and are designed to generate intense turbulence in the incoming raw water; (5) hydraulic flocculators, which follows directly after the rapid mix process and provides gentle and continuous agitation, during which suspended particles in the water coalesce into larger masses so that they may be removed from the water in subsequent treatment processes; (6) horizontal-flow settling basins, the sedimentation process is responsible for the settling and removal of suspended material from water; (7) rapid filters; (8) slow sand filters; and (9) modular water treatment plants. (Lantz-PTT)
W87-07655

MODEL-BASED DESIGN OF WATER DISTRIBUTION AND SEWAGE SYSTEMS,
Asian Inst. of Tech., Bangkok (Thailand).
H. W. Orth.
John Wiley and Sons, New York, New York. 1986. 191 p.

Descriptors: *Hydraulic design, *Water distribution, *Water transport, *Sewers, Sewer systems, *Model studies, *Design standards, Cost analysis, Hydraulic properties, Economic aspects, Mathematical studies.

Many optimization models for the design of water distribution and sewage systems have been developed during the last two decades. They provide effective support for the designer in achieving both a technically improved design as well as lower construction and operation cost. It is the objective of this book to make these techniques more accessible through a systematic introduction to this relatively new field. The first part of the book deals with fundamentals of design models. Hydraulic and economic fundamentals are reviewed only briefly. The main objective of the review is to clarify on which fundamentals such models are based and to discuss some interdependencies between these fundamentals and design models. The review also contains some suggestions for practical application. The second part of the book deals with individual design models. Given the number of models or proposals currently available any selection is necessarily somewhat arbitrary. As a guideline for the selection of models, priority is given to models which are easy to implement and which enhance the understanding of the way design models should be applied. Particular emphasis is placed on the use of design models, not as a black box but as a tool which can be flexibly adjusted to the needs of an individual design problem. (Lantz-PTT)
W87-07656

GROUNDWATER TREATMENT TECHNOLOGY,
DETOX, Inc., Dayton, OH.
For primary bibliographic entry see Field 5G.
W87-07701

URBAN WATER INFRASTRUCTURE: PLANNING, MANAGEMENT, AND OPERATIONS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 5D.
W87-07703

WATER QUALITY IN DISTRIBUTION NETWORKS,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
A. D. Hulsmann, F. A. M. Hettinga, and G. H. Ekkers.
Aqua AQUAAA, No. 6, p 312-317, 1986. 6 fig, 3 ref.

Descriptors: *Water quality, *Water distribution, *Water quality management, *Maintenence, *Water treatment facilities, Cleaning, Networks, Distribution.

In order to maintain the quality of drinking water it is essential to have a complete understanding of underlying causes of its deterioration. This is especially important where cast-iron pipelines are used, as in the Netherlands, for example, to transport drinking water. A systematic approach is necessary to discover the cause of water quality problems. The Netherlands Waterworks' Testing and Research Institute uses a varity of methods to determine the quality of water in the distribution system. The choice of methods depend upon the nature of consumers' complaints. The Institute employs an apparatus which can be connected to any pipeline and monitors oxygen, temperature, turbidity, hydrogen ion concentration, redox potential, conductivity and pressure. The results are interperated by computer. Also, water samples to determine parameters which can not be monitored continuously, such as, manganese and iron content and bacterial counts. Depending upon the problem additional measurements such as, animal life, calcium carry over, modified fouling index and pipe samples, are taken. PVC pipes are better than cast-iron pipes. In PVC pipes the oxygen levels are much higher and turbidity levles are lower than those in cast-iron pipes. Rehabilitation of old cast-iron pipes in the Netherlands includes complete replacement to flushing. The flushing procedure is not very effective. Other methods of rehabilitation consist of air-scouring, swabbing with foam pigs, high pressure jet, cement-mortor lining, relining with a new pipe line. In order to decide on the proper and cost effective method collection and consideration of all the necessary information is advisable. (Ray-PTT)
W87-07784

APPLICATION OF BIOINDICATION FOR SCIENTIFIC RESEARCH OF WATER DISINFECTION,
Akademia Medyczna, Warsaw (Poland).
J. Sobotka.
Aqua AQUAAA, No. 6, p 318-320, 1986. 2 fig, 3 tab, 4 ref.

Descriptors: *Water treatment, *Disinfection, *Water distribution, *Bioindicators, *Ultraviolet radiation, *Chlorination, Survival, Enchytraeus.

Enchytraeus albidus organisms survive for a long-time in a water environment, have simple structure and are easy to grow. This organism was needed to follow the effect of ultraviolet radiation of chlorination in water distribution studies. It was observed that an irradiation dose of 7100 Ws/sq m of 254 nm wave length lowers the chlorine requirement by half for 50 percent reduction of the test organism. (Ray-PTT)
W87-07785

PURIFICATION OF POLLUTED SOURCE WATER WITH MICROFLOCCULATION/ DIRECT FILTRATION - BIOLOGICAL ACTIVATED CARBON PROCESS,
Harbin Civil Engineering Inst. (China). Water Pollution Control Lab.
B. Z. Wang, J. L. Fu, G. M. Shi, D. Z. Wang, and X. H. Liu.
Aqua AQUAAA, No. 6, p 321-326, 1986. 14 fig, 3 tab, 9 ref.

Descriptors: *Water treatment, *Water purification, *Direct filtration, *Microflocculation, *Biological activated carbon process, Turbidity, Color, Ions, Metals, Pollutants, Pilot plants.

Trial runs utilising a small (500 cu m per day) water treatment plant, designed by the authors, showed that microflocculation/ direct filtration followed by biological activated carbon treatment is very effective in removing various pollutants. Under normal operating conditions the following removal efficiencies (mean values) were obtained: turbidity, 97.8%; color, 67.5%; phenol, > 80%; cyanide, > 65%; fluoride, 90.1%; DBS, 97.5%; NH3-N, 82.8%; NO2(-)-N, 86.7%; NO3(-)-N, 8.5%; Fe, 90%; Mn, 80%; and Cu, 92.5%. Mechanism of the removal of the pollutants were also discussed. (Ray-PTT)
W87-07786

PATHOLOGY LINKED TO WATER USE (PATHOLOGIE LIEE A L'USAGE DE L'EAU),
Lille-2 Univ. (France).
For primary bibliographic entry see Field 5C.
W87-07787

TOXICOGENETIC EFFECTS LINKED TO THE CHLORINATION OF DRINKING WATER (EFFETS TOXICOGENETIQUES LIES A LA CHLORATION DES EAUX ALIMENTAIRES),
Liege Univ. (Belgium). Inst. de Pathologie.
For primary bibliographic entry see Field 5B.
W87-07788

BACTERIOLOGICAL CONTROL OF DISTRIBUTED WATER (LE CONTROLE BACTERIOLOGIQUE DES EAUX DE DISTRIBUTION),
R. Germonpre.
Aqua AQUAAA, No. 6, p 337-343, 1986. 5 fig, 10 tab, 8 ref.

Descriptors: *Pollutant identification, *Water quality, *Bacteriological control, *Water distribution, *Sulfur reducing bacteria, Feces, Bacteria, Coliforms, Bioindicators, Pathogens, Diseases, Pollutants.

Bacterial control of distributed water is essentially based on the study of indicative organisms such as E. coli, Streptococcus and Clostridium in fecal pollution. This method is found to be superior to the use of pathogenic organisms in water, especially since the infections transmitted by water also have fecal origin. E. coli and Streptococcus detect the presence or absence of pollutants by reducing TTC, triphenyl tetrazolium chloride or after incubation producing characteristically colored colonies. The presence of Streptococcus is an inferior method of pollution detection than that of E. coli. But since the former is more resistant, it renders the control technique more efficient and certain. The Clostridia are sulfite reducers and are very resistant to chlorine at levels normally used in water disinfections. Their presence can be detected based on the blackening of the medium around the developing colonies due to the formation of sulfur. Bacterial analysis can also be achieved by counting the number of common germs in a petri culture when a water sample is incorporated into the medium. This technique should be qualified with other tests for most accurate results. (Ray-PTT)
W87-07789

TECHNIQUES FOR THE ELIMINATION OF VIRAL PARTICLES (TECHNIQUES D' ELIMINATION DES PARTICULES VIRALES),
Centre de Recherche Lyonnaise des Eaux - Degremont, Le Pecq (France).
M. Rizet, N. Dumoutier, and D. Bellachen.
Aqua AQUAAA, No. 6, p 343-349, 1986. 5 fig, 8 tab, 17 ref.

Descriptors: *Disinfection, *Drinking water, *Coagulation, *Decantation, *Virus removal, *Water treatment, Survial, Filtration.

Of the several sequential steps used in the removal of virues from drinking water sources are: prechlorination, coagulation, decantation, filtration and final disinfection. The coagulation/decantation and final disinfection steps are considered to be the most decisive ones. Although some disinfectants were found to be superior to others in treating the same virus mainly because of their optimal hydrogen ion concentration values, their effectiveness remains a function of the concentration level in water. The longevity of numerous viruses in water has received much attention, notably in the inacti-

vation of the outflow of filtering stations. Even so, many viruses such as Poliovirus or Echovirus survive in subteranean waters. These measures reveal the intrusion of viruses over the course of years by infiltration of contaminated waters. (Ray-PTT)
W87-07790

CONTROL OF THE WATER QUALITY OF SPA (LE CONTROL DE LA QUALITE DES EAUX DE SPA.),
For primary bibliographic entry see Field 5G.
W87-07791

PURIFICATION OF POLLUTED SOURCE WATER WITH OZONATION AND BIOLOGICAL ACTIVATED CARBON,
Harbin Civil Engineering Inst. (China). Water Pollution Control Lab.
B. Z. Wang, J. Z. Tian, and J. Yin.
Aqua AQUAAA, No. 6, p 351-357, 1986. 17 fig, 1 tab, 17 ref.

Descriptors: *Water treatment, *Comparison studies, *Water purification, *Filtration, *Ozonation, *Biological activated carbon process, Adsorption, China, Turbidity, Color, Odors, Metals, Ions.

In order to find an effective process for purifying polluted source water in Harbin City, various processes consisting of ozonation, sand filtration, and/or GAC filtration and adsorption, i.e. ozonation (process 'O3'), ozonation- sand filtration (process 'O3 + SF'), ozonation-biological activated carbon (process 'O3+BAC'), ozonation-sand filtration-biological activated carbon (process 'O3+SF+BAC') and biological activated carbon (process 'BAC') were tested in a pilot plant of 8 cu m per day capacity. In addition, a small plant of 500 liter per day capacity was used to conduct comparative studies between two processes 'BAC' and 'O3+BAC' as well as two types of carbon. The results have shown that, of the processes tested, both the processes 'O3+BAC' and 'O3+SF+BAC' are most effective in removing various pollutants, including turbidity, color, odor, iron, manganese, organic substances measured by COD, BOD and chromatograms, ammonium, nitrite and nitrate. Specific efficiencies and mechanisms for removing such pollutants are described and discussed in detail. Based on results of the study, two treatment flowsheets were put forward for purifying polluted surface source water and polluted ground water, respectively. (Author's abstract)
W87-07792

PUMP INSTALLER DOES RESEARCH TO 'ZAP' IRON BACTERIA,
S. Hurlburt.
Water Well Journal WWJOA9, Vol. 41, No. 2, p 33-36, February 1987.

Descriptors: *Pollutant identification, *Water treatment, *Iron bacteria, *Gamma radiation, *Cobalt radioisotopes, *Wells, Sediments, Corrosion, Bacteria, Research.

Iron related bacteria causes extensive build-up of sediments in wells requiring frequent cleaning. Contrary to popular belief iron related bacteria is not confined to south eastern United States only but is found in almost every state. It can also grow in cold and oxygen deficient waters. Occasionally a driller inadvertently contaminate wells by using improperly treated drill-water. A driller proposes to use gamma radiation from cobalt radioisotopes to destroy the iron bacteria and has recently been awarded an EPA research grant to demonstrate the feasibility of this idea. He is also working with others to control and use bacteria as a tool for degradation of organic spills. Besides research and operating the family business he is very much involved in enlightening the scientific community and public about the specifics of iron bacteria. Since a combination of pressurized acidification and chlorination keeps the wells free from plugging by iron bacteria and in the absence of any other presently available technology capable of controlling these bacteria, he suggests that acidification/chlorination procedure should be continued. He recommends that although trouble-free, maximized water production in the well is the primary goal, research should encompass groundwater as a total concept. (Ray-PTT)
W87-07795

REVIEW OF CHEMICAL TREATMENT STRATEGIES FOR IRON BACTERIA IN WELLS,
G. Hackett.
Water Well Journal WWJOA9, Vol. 41, No. 2, p 37-42, February 1987. 4 fig, 1 tab, 15 ref.

Descriptors: *Water treatment, *Iron bacteria, *Chemical treatment, *Reviews, *Wells, Corrosion, Bacteria, Fouling.

Chemical treatment to rehabilitate wells affected by iron bacteria consists of several successive steps. For example, addition of phosphates with a disinfectant, followed by acid, followed by a disinfectant. In many cases the effectiveness of the treatment is short and the treatment process has to be repeated. The resistance of the iron bacteria to such chemical treatments is due to the unique nature of this type of bacteria itself. Since they are capable of attaching themselves to surfaces they can survive in low nutrient enviroments. Also they excrete extracellular polymers which are predominantly polysaccharides not only to protect them from attack by external enviroment but also to provide much needed nutrients. The precipitation of iron hydroxide as a result of the activity of these bacteria also protects them from chemical attack. In order to comb the defensive arrangements of these bacteria multiple and adequate treatment steps are necessary. For example, addition of surfactants keep the iron in solution and disperses the polymeric material to enhance disinfection by chlorine based compounds like calcium and sodium hypochlorites. It should be noted, however, that these treatments do not prevent the recurrence of the problem since the pathway by which the iron bacteria entered the wells may still exist. In that case the treatment will only be temporarily successful. (Ray-PTT)
W87-07796

PATTERNS OF DENTAL FLUOROSIS IN A EUROPEAN COUNTRY IN RELATION TO THE FLUORIDE CONCENTRATION OF DRINKING WATER,
Aarhus Tandlaegehojskole (Denmark). Dept. of Dental Pathology and Operative Dentistry.
M. J. Larsen, E. Kirkegaard, and S. Poulsen.
Journal of Dental Research JDREAF, Vol. 66, No. 1, p 10-12, January 1987. 4 fig, 1 tab, 11 ref.

Descriptors: *Dentition, *Drinking water, *Public health, *Fluorides, *Fluoridation, Fluorosis, Children, Europe.

Variation in dental fluorosis within a dentition has been believed to be caused by a variety of biological factors with the assumption that daily fluoride intake increases proportionally with body weight from birth throughout the period of tooth formation. A recent study involving the use of fluoride tablets has suggested that the level of fluorosis within individual types of teeth is related to the fluoride intake during the period when the particular teeth were formed. The objective of this study was to describe the prevalence and severity of dental fluorosis in high- and low-fluoride areas in a modern European country in relation to the age during which individual tooth types were formed. Dental fluorosis among 456 14 to 16 year-old schoolchildren in Denmark who had resided continuously since birth in their respective study areas was recorded using the Thylstrup and Fejerskov classification system. The children fell into four groups according to fluoride concentration of their drinking water: (1) less than or equal to 0.1 ppm; (2) 0.3-0.5 ppm; (3) 0.5-1.25 ppm; and (4) 1.26-2.0 ppm. It was found that the later in childhood the tooth was formed, the higher was the prevalence of dental fluorosis. The fluoride concentration in the drinking water affected the prevalence of dental fluorosis in all teeth except the lower incisors, which are formed very early in life. Apart from these teeth, the proportionate increase of dental fluorosis with increasing water fluoride concentration was almost the same for all tooth types. However, the actual amount of increase in the prevalence and degree of fluorosis was greatest among those teeth that formed later during childhood. The observed fluorosis is presumed to result from and reflect the drinking water habits in the population as well as the patterns of use of fluoride prophylactics. (McFarlane-PTT)
W87-07805

FLUORIDE SUPPLEMENTS,
Wayne State Univ., Detroit, MI. Dept. of Pediatrics.
F. J. Margolis, B. K. Chesney, and M. A. Schork.
American Journal of Diseases in Children, Vol. 141, No. 1, p 72-76, January 1987. 8 tab, 8 ref.

Descriptors: *Fluoridation, *Fluorides, *Water Treatment, *Public health, *Dental caries.

The results of a 1981 survey of randomly selected primary care physicians with pediatric patients were compared with the results of a similar survey conducted in 1978. In general, the 1981 respondents were more knowledgeable on the subject of fluoride and dental caries, had more positive attitudes about the effectiveness of fluoride supplementation, were more likely to prescribe fluoride supplements, and more closely followed the current guidelines for appropriate use of fluoride supplements. An intensive, multifaceted educational program on fluoride and childhood dental caries sponsored by the Wayne State University School of Medicine, Detroit, which started shortly after the first survey, may have contributed to these changes. (Authors' abstract)
W87-07823

MAINTENANCE PAINTING PROGRAM OPENS TAP TO CONVENIENCE,
J. Domazet.
Water Engineering and Management WENMD2, Vol. 134, No. 1, p 34-35, January 1987.

Descriptors: *Water treatment facilities, *Maintenance, *Maintenance costs, Operating costs, Operating policies, Management planning.

By having one maintenance painting company handle most of its painting needs, the Fairfax County Water Authority in Virginia has realized a new level of operational convenience. Painting is an essential maintenance function because steel water treatment facilities are attacked by such corrosive compounds as chlorine vapors, fluoride, caustic soda and lime used in the process, as well as water itself. If propoerly maintained, such facilities will last 50 years or more. The Authority is using a long-term (10 yr) price-guaranteed contract for corrosion protection. The service company assumes responsibility for painting the facility at an agreed-upon level of protection for a predetermined fee. The fixed fee allows the Authority to budget this operation for an extended period of time. There is a very narrow window for painting. The maximum demand of summer means all facilities must be available for production. Winter temperatures are too low for painting. All painting must be done in spring and fall but completed on schedule to maintain service to water customers. Painting procedures called for a near white metal blast, cleansing of all dust and grit, a high-build epoxy primer coat free of microscopic pinholes, and washings between application of intermediate and top coats. Application is both an art and a science. (McFarlane-PTT)
W87-07831

IODINATION OF NUTRIENTS IN THE PRESENCE OF CHLORINE BASED DISINFECTANTS USED IN DRINKING WATER TREATMENT,
Health Effects Research Lab., Cincinnati, OH.
J. P. Bercz, and R. Bawa.
Toxicology Letters TOLED5, Vol. 34, No. 2/3, p 141-147, December 1986. 1 fig, 3 tab, 5 ref.

Descriptors: *Iodination, *Water treatment, *Chlorination, *Chlorine, *Residual chlorine, Ha-

logens, Chemical treatment, Public health, Disinfection.

In vivo toxicology studies with chlorine dioxide (ClO_2) have provided evidence that disinfectants cause covalent immobilization of iodide in the gastrointestinal tract of rats and inhibit thyroxine synthesis in monkeys. This study examined the redox interaction between iodide and nutritional biochemicals and complex nutrients in the presence of disinfectants. Under conditions simulating the gastrointestinal tract chlorine dioxide, HOCl, and NH_2Cl caused covalent organification of iodide to nutrient biochemicals. The extent of binding seemed to be proportional to the electromotive force and stoichiometry of the redox couple between iodide and the oxidant. Almost half of 71 nutrients examined were found to bind reactive iodine. Iodide was found to inhibit the quinoidal chromogen formation from tyrosine and ClO_2, demonstrating the preferential generation of reactive iodine in complex organic mixtures. These findings indicate that ingestion of residual disinfectants via drinking water may pose a health risk in terms of in vivo generation of iodinated organics. Structure, formation, and biological activity of these compounds are under study. (Authors' abstract)
W87-07834

REMOVAL OF N-ALCOHOLS FROM AQUEOUS STREAMS USING MICELLAR-ENHANCED ULTRAFILTRATION,
Oklahoma Univ., Norman. Inst. for Applied Surfactant Research.
L. L. Gibbs, J. F. Scamehorn, and S. D. Christian.
Journal of Membrane Science JMESDO, Vol. 30, No. 1, 67-74, January 1987. 6 fig, 10 ref. DOE Contract DE-AS05-84ER13175.

Descriptors: *Ultrafiltration, *Water treatment, *Alcohols, *Organic solutes, *Membrane processes, *Separation techniques, *Pollutants, *Micellar-enhanced ultrafiltration,Surfactants, Filtration, Organic compounds, Aggregates, Solutes, Hexanol, Heptanol, Octanol.

Micellar-enhanced ultrafiltration (MEUF) is a membrane separation process which may be used to remove dissolved organic solutes from water. In MEUF, surfactant is added to the aqueous stream and forms aggregates called micelles into which the solute stabilizes. The stream is then forced through an ultrafiltration filter with pores small enough to reject the micelles containing the solute. The removal of n-hexanol, n-heptanol, and n-octanol from water using MEUF was studied. Alcohol rejections varied from 71% to 98.8% for the conditions studied, demonstrating the feasibility of the method. Rejection increased with increasing hydrocarbon chain length of the alcohol and decreasing alcohol/surfactant ratio. The alcohol in the permeate appears to be in equilibrium with the alcohol in the retentate, the total concentration difference being caused by the presence of micelles on the retentate side. Surfactant rejections were greater than 98% for all cases studied. Excellent fluxes were also observed. (Author's abstract)
W87-07858

CROSSFLOW MEMBRANE FILTRATION EXPANDS ROLE IN WATER TREATMENT,
G. J. Gach.
Power POWEAD, Vol. 130, No. 12, p 65-70, December 1986. 6 fig, 1 tab.

Descriptors: *Water treatment, *Membrane filters, *Reverse osmosis, *Ultrafiltration, *Particulate matter, *Filtration, *Membrane processes, Performance evaluation, Wastewater treatment, Solids, Filters, Colloids, Salts, Technology, Powerplants, Boiler water, Polymers, Acidity, Benefits.

Crossflow membrane filtration differs from the normal-flow process in that the influent stream is separated into two streams, the permeate and concentrate. This approach has the advantage that the membrane is operated in a continuously self-cleaning mode, with solutes and solids swept away by the concentrate stream running parallel to the membrane. Features of the system are reviewed. Topics covered include membrane characteristics and selection criteria, the role of pH, ultrafiltration-module configurations, reverse-osmosis configurations, system design and operation, and the combined treatment approach. (Doria-PTT)
W87-07924

RECENT ADVANCES IN WATER TREATMENT PROCESSES,
Montgomery (James M.), Inc., Pasadena, CA.
S. Kawamura.
Public Works PUWOAH, Vol. 118, No. 1, p 63-65, 104, 106, January 1987.

Descriptors: *Water treatment, *Reviews, *Reservoir operation, *Coagulation, *Flocculation, *Settling tanks, *Filters, *Chemical treatment, Destratification, Reservoirs, Mixing, Chemical coagulation, Wastewater treatment, Water quality management, Filtration, Sand filters, Ozone, Ozonation, Polymers, Desalination, Sludge disposal, Distillation, Membrane processes, Crystallization, Cost-benefit analysis.

The latest advances in water treatment processes are reviewed, including the following: (1) artificial destratification of lakes and reservoirs, which has significantly improved water quality and the reduction of the burden on water treatment plants; (2) chemical flash mixing to ensure homogeneous coagulation with completely uniform dispersion of the coagulant throughout the water; (3) high-energy flocculation (velocity gradient of 100/sec), quite effective in removing organic contaminants, haloform precursors, and asbestiform and other inorganic compounds with filtration; (4) high-rate settler modules (gravitation settling modules with a detention time of 6-30 minutes); (5) valveless self-backwashing filters; (6) high-rate filters (4-12 gpm/sq ft); (7) new water treatment chemicals, including ozone and synthetic high molecular weight polymers; and (8) miscellaneous processes, including desalting techniques, sludge disposal methods, and high-gradient magnetic separation. Supervisory and control techniques, including continuous monitoring of raw and finished water quality, are also described. (Doria-PTT)
W87-07926

FORMALIZING TREATMENT PLANT MAINTENANCE,
Saint Petersburg Dept. of Public Works, FL.
For primary bibliographic entry see Field 5D.
W87-07937

WATER REGULATIONS AND THE DIRECTION OF THE EPA,
Environmental Protection Agency, Dallas, TX. Region VI.
For primary bibliographic entry see Field 5G.
W87-08068

ADSORPTION AND MICROBIOLOGICAL MECHANISMS FOR REMOVAL OF NATURAL ORGANICS IN GRANULAR ACTIVATED CARBON COLUMNS,
California Univ., Los Angeles. Office of Environmental Science and Engineering.
W. H. Glaze, C.-C. Lin, J. C. Crittenden, and R. Cotton.
Ozone Science and Engineering OZSEDS, Vol. 8, No. 4, p 299-319, 1986. 11 fig, 2 tab, 29 ref. EPA Grant CR-806157, NSF Grant CEE-7924589.

Descriptors: *Organic compounds, *Water treatment, *Activated carbon, *Surface water, *Biological treatment, *Model studies, *Adsorption, Preozonation, Ozone, Performance evaluation, Kinetics, Prediction.

Performance data for GAC columns treating surface water are analyzed to determine the relative importance of physical adsorption and biological activity, with and without preozonation. Kinetic and equilibrium adsorption parameters for the source water are used in the Homogeneous Surface Diffusion model to predict GAC performance over 83 weeks. The model underestimates removal of TOC for ozonated and unozonated streams by 46% and 28%, respectively, which is attributed to omission of biological removal in the model. (Author's abstract)
W87-08071

AUTOMATED PROCEDURE FOR MONITORING THE EFFECTIVENESS OF OZONATION PROCESSES,
Centre de Recherche Lyonnaise des Eaux - Degremont, Le Pecq (France).
J. P. Duguet, E. Brodard, M. Roustan, and J. Mallevialle.
Ozone Science and Engineering OZSEDS, Vol. 8, No. 4, p 321-338, 1986. 14 fig, 4 tab, 11 ref.

Descriptors: *Analytical methods, *Performance evaluation, *Ozonation, *Drinking water, *Water treatment, Ozone, Monitoring, Spectral analysis, Organic matter, Kinetics, Seasonal variation.

Measurement of the 254 nm absorption of organics was chosen for monitoring the ozonation processes used to remove organic matter in a drinking water because of its ability to reflect the performance of ozonation. Ozone flow rate, ozone concentration in the gas phase, addition of H_2O_2, and seasonal variations on kinetics of the reduction of UV absorption were varied, and the efficiency of ozonation was determined. (Author's abstract)
W87-08072

ULTRAVIOLET-ENHANCED OZONATION OF ORGANIC COMPOUNDS: 1,2-DICHLOROETHANE AND TRICHLOROETHYLENE AS MODEL SUBSTRATES,
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
S. J. Masten, and J. N. Butler.
Ozone Science and Engineering OZSEDS, Vol. 8, No. 4, p 339-353, 1986. 7 fig, 2 tab, 18 ref. EPA Grant EPA-R808209-01-0.

Descriptors: *Water treatment, *Ultraviolet radiation, *Organic compounds, *Ozonation, *Chlorinated solvents, *Model studies, Oxidation, Hydrogen peroxide, Ozone.

1,2-Dichloroethane (DCE) and trichloroethylene (TCE) were used as model compounds to study the oxidation of organic chemicals by ozone/ultraviolet radiation, ozone, and hydrogen peroxide/ultraviolet radiation. It was found that ozone/ultraviolet radiation oxidized both 1,2-dichloroethane and trichloroethylene in batch systems, at pH = 2 (phosphate buffer). At ozone concentrations in the 1 to 5 mg/L range, the reaction was first order in both ozone and substrate. At pH = 2 and initial ozone concentration 2.2-2.6 mg/L, rate constants k sub O = 25 and 130 M/s were observed for the ozone/ultraviolet radiation oxidation of DCE and TCE, respectively. The rate constants for ozone oxidation of DCE and TCE without ultraviolet radiation were 4.3 and 47 M/s, respectively. The higher rate of TCE oxidation implies that direct reaction occurs with the double bond. Finite reaction rate of DCE with ozone, and substantial increases in rate at higher pH imply the participation of hydroxyl radicals in the oxidation of both compounds. For example, at pH = 7, initial ozone concentration of 2.3 mg/L, the k sub O for TCE oxidation by ozone/ultraviolet radiation is approximately 500 M/s, almost too fast to measure in a batch system. The rate also is increased by increased ultraviolet radiation intensity, and by the presence of hydrogen peroxide, which acts as a catalyst. (Author's abstract)
W87-08073

INFLUENCE OF OZONATION ON THE GAC ADSORBABILITY OF ORGANIC SUBSTANCES IN ACTIVATED SLUDGE EFFLUENT,
Pretoria Univ. (South Africa). Dept. of Chemical Engineering.
J. van Leeuwen.
Ozone Science and Engineering OZSEDS, Vol. 8, No. 4, p 355-365, 1986. 4 fig, 5 tab, 11 ref.

Descriptors: *Wastewater renovation, *Water reuse, *Water treatment, *Ozonation, *Activated

carbon, *Adsorption, *Organic compounds, *Activated sludge, *Effluents, Performance evaluation, Ozone, Carbon, Biodegradation, Desorption, Substrates.

The effect of preozonation on activated sludge effluent before activated carbon treatment was evaluated in terms of its effect on the adsorption process. It was found that the total removal of organic substances by the combined action of ozone and activated carbon was superior than by either ozone or activated carbon separately. Although ozonation leads to a decrease in the adsorbability of organic substances, the overall removal of organic substances is not impaired except during the early stages of operation before an effective biogrowth is established. Preozonation extends the operational life of activated carbon. This is explained, in part, by improved desorption and biodegradation of the adsorbate. (Author's abstract)
W87-08074

DEVELOPMENT OF VILLAGE WATER SUPPLY AND SANITATION IN SIERRA LEONE,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
H. D. M. Speed.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 41, No. 1, p 15-30, February 1987. 10 fig.

Descriptors: *Water supply development, *Developing countries, *Sanitation, *Sierra Leone, *Drinking water, Public health.

The United Nations Water and Sanitation Decade, now at its mid point, has not attained the 'household word' status for which its sponsors might have hoped. However, after early disappointment there is evidence that real progress has been made in the provision of water supplies to under-developed countries, and whilst some 1850 million people, about two-thirds of the world's population, lacked access to safe drinking water at the start of the decade in 1981, some 300 million have benefited since. It will take many decades to provide all the world's people with safe water and sanitation but without the stimulus of the UN Decade the timescale would have been immeasurably extended. The formation of Water Aid as a direct answer to the challenge of the Decade has revealed a most remarkable capacity for caring and giving within the water industry and its consumers, greatly reassuring in a world so often branded as selfish and cynical. This account of one small corner of Water Aid's field personnel, living, working and journeying in taxing and often frustrating conditions. Being unable to respond to the real anguish of many of the communities visited can be a harsh and deeply wounding experience and one which most certainly is never forgotten. Having to say no to a community for whom the arrival of the Water Aid Vehicle is greeted as an answer to long prayers is very hard. By contrast, the joy brought by a successfully completed scheme is reward of a very high order. These successes, however small, mark steps on the road to solving this immense problem. (Alexander-PTT)
W87-08086

ICA - INFORMATION SYSTEMS - WHERE NEXT,
Bristol Waterworks Co. (England).
For primary bibliographic entry see Field 7A.
W87-08087

GROUNDWATER SUPPLY AND ADVANCED WATER TREATMENT IN OMAN,
D. H. F. Gamble, and C. M. Biggin.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 41, No. 1, p 55-74, February 1987. 4 fig, 13 tab, 17 ref.

Descriptors: *Groundwater development, *Water treatment, *Design criteria, *Oman, Developing countries, Water resources development, Fluorides, Economic aspects, Groundwater, Water supply.

The first part of the paper deals with water resources assessment and development, carried out over a period of two years, in four phases: (1) Initial investigations; (2) Further investigations; (3) Groundwater exploration, and (4) Groundwater development. The second part of the paper deals with water treatment and supply and discusses the following aspects: (a) Existing plant and proposed extensions; (b) Design criteria; (c) Proposed plant; (d) Fluoride removal; and (e) Economy and operation. (Author's abstract)
W87-08089

INTEGRATED SYSTEM FOR TREATING NITROGEN SUPERSATURATED WATER,
National Fishery Research Lab., La Crosse, WI.
V. K. Dawson, and L. L. Marking.
The Progressive Fish Culturist PFCUAY, Vol. 48, No. 4, p 281-284, October 1986. 2 fig, 1 tab, 9 ref.

Descriptors: *Vacuum degassing, *Water treatment, *Nitrogen supersaturation, *Fisheries, *Groundwater, Trout, Salmon, Nitrogen, Oxygen, Gasses, Wells, Fish.

Groundwater is commonly supersaturated with nitrogen and must be treated before it is used for culturing fish-especially sensitive species such as lake trout (Salvelinus namaycush) and Atlantic salmon (Salmo salar). Water was treated with an integrated system that passed water through a packed column aerator, then through a vacuum degasser, and finally through another packed column aeration prior to vacuum degasser, and finally through another packed column aerator (installed as a backup system). Packed column aeration prior to vacuum degassing provided increased efficiency because only a small amount of vacuum was required to remove the remaining excess nitrogen, and oxygen levels were not affected by the vacuum degasser. In well water passed through packed columns, nitrogen gas was reduced from 131 to 105% of saturation and oxygen was increased from 23 to 86% of saturation. With a vacuum pressure of 3 in Hg, the degasser further reduced the nitrogen gas from 105 to 99% of saturation, and oxygen saturation remained near 86%. The integrated system provided water in which all gases were near saturation. No effects of gas supersaturation have been observed among the 18 species of cold-water, coolwater, or warmwater fish that have been cultured in this water. (Author's abstract)
W87-08114

ROLE OF RIVERBANK FILTRATION ALONG THE RHINE RIVER FOR MUNICIPAL AND INDUSTRIAL WATER SUPPLY,
Technische Univ. Hamburg-Harburg (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W87-08153

BANK AND DUNE INFILTRATION OF SURFACE WATER IN THE NETHERLANDS,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands). Lab. of Organic Chemistry.
For primary bibliographic entry see Field 5G.
W87-08154

COMMUNITY WATER SUPPLY IN DEVELOPING COUNTRIES: LESSONS FROM EXPERIENCE, EVALUATION SUMMARIES AND CONFERENCE FINDINGS,
Agency for International Development, Washington, DC.
D. M. Dworkin.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-243302. Price codes: A05 in paper copy; A01 in microfiche. A.I.D. Program Evaluation Report No. 7, September 1982. 94 p, 9 fig, 5 tab, 3 append.

Descriptors: *Water supply, *Developing countries, *Rural areas, *Kenya, *Korea, *Panama, *Peru, *Tanzania, *Thailand, *Tunisia, Project planning, Economic aspects, Water quality.

Because efforts to improve rural water supplies in developing countries have faced increasing criticism and declining donor interest in recent years, A.I.D. began a 3-year effort in 1979 to analyze its experience with community water supply projects. From 1979-1982, 15 projects funded by A.I.D. and other donors in Kenya, Korea, Panama, Peru, Tanzania, Thailand, and Tunisia were evaluated in terms of the water systems' reliability, benefits and accessibility (i.e., equity). This report presents the full proceedings and recommendations of a 1982 conference held to discuss the results of these field evaluations. The evaluations were conducted to field test the relevance of the following hypothetical attributes of successful water projects; host country and community commitment; realistic national goals; financially sound support institutions; coordination of donor support with all project needs; appropriate technology; the presence of complementary health, education, and sanitation activities; and increased availability of clean water. In general, the evaluations supported the above hypotheses; in depth discussions of each point are presented. The participants went on to recommend that: (1) A.I.D. use both Health Account and Food and Nutrition Account funds for water projects; (2) the issue of water quality be addressed within a project's socioeconomic setting; (3) community interest be gauged early on and projects be designed to be locally self-supporting; (4) strong financial and technical institutions be developed to oversee system construction and maintenance; (5) related training needs be adequately addressed; and (6) special sanitation and education components not be included automatically but on the basis of local need and demand. (Author's abstract)
W87-08234

CHLORINATION BYPRODUCTS OF ARABIAN GULF SEAWATER,
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
N. M. Fayad, and S. Iqbal.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 38, No. 3, p 475-482, March 1987. 7 fig, 11 ref.

Descriptors: *Pollutant identification, *Chemical reactions, *Chlorination, Chlorine, Halogens, Water treatment, Humic material, Oxidation, Arabian Gulf, Wastewater treatment, Organic compounds, Seawater.

Chlorination of saline cooling water results in the formation of many halogenated organic compounds which originate from the reaction of chlorine and/or bromine with the naturally occurring humic substances in seawater. When chlorine is added to seawater, much of it is consumed in the oxidation of naturally occurring organic and inorganic materials. Therefore the harmful effects of the chlorinated discharges can most probably be attributed to the reaction by-products. This study identifies volatile and semivolatile organic compounds formed in chlorinated seawater from the Arabian Gulf. The total organic carbon content of the seawater was 10 ppm; bromide ion concentration was 120 ppm; and total oxidant demand was 0.12 ppm chlorine. Bromoform ($CHBr_3$) and chlorodibromomethane ($CHClBr_2$) were the major volatile organic compounds found after chlorination at 1.2, 0.8, and 0.6 ppm chlorine. At 0.8 ppm chlorine, chloroform and carbon tetrachloride was also formed. Three major halogenated compounds were also formed, tentatively identified as 2-bromocyclohexanol, 1-bromo,2-chlorocyclohexane, and 1,2-dibromocyclohexane. These reaction by-products may be environmentally more important than the extensively studied haloforms. The persistence, biological accumulation, and transfer of these compounds in the aquatic environment is not known. (McFarlane-PTT)
W87-08261

SURVIVAL OF SELECTED BACTERIAL SPECIES IN STERILIZED ACTIVATED CARBON FILTERS AND BIOLOGICAL ACTIVATED CARBON FILTERS,
Technische Univ. Berlin (Germany, F.R.). Dept. of Hygiene.
Y. Rollinger, and W. Dott.

Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 4, p 777-781, April 1987. 4 fig, 7 tab, 24 ref.

Descriptors: *Water treatment, *Activated carbon filters, *Biological water treatment, *Survival, *Bacteria, Inoculation, Incubation, Cultures, Effluents, Limiting nutrients, Filters, Tap water, Microbiological studies, Carbon.

The survival of selected hygienically relevant bacterial species in activated carbon (AC) filters on a bench scale was investigated. The results revealed that after inoculation of the test strains the previously sterilized AC adsorbed all bacteria (1,000,000 to 10,000,000). After a period of 6 to 13 days without countable bacteria in the effluent, the numbers of Escherichia coli, Pseudomonas aeruginosa, and Pseudomonas putida increased up to 10,000 to 100,000 CFU/ml of effluent and 1,000,000 to 10,000,000 CFU/g of AC. When Klebsiella pneumoniae and Streptococcus faecalis were used, no growth in filters could be observed. The numbers of E. coli, P. aeruginosa, and P. putida, however, decreased immediately and showed no regrowth in nonsterile AC from a filter which had been continuously connected to running tap water for 2 months. Under these conditions an autochthonous microflora developed on the carbon surface which could be demonstrated by scanning electron microscopy and culturing methods (heterotrophic plate count). These bacteria reduced E. coli, P. aeruginosa, and P. putida densities in the effluent by a factor of more than 100,000 within 1 to 5 days. The hypothesis that antagonistic substances of the autochthonous microflora were responsible for the elimination of the artificial contamination could not be confirmed because less than 1% of the isolates of the autochthonous microflora were able to produce such substances as indicated by in vitro tests. Competition for limiting nutrients was thought to be the reason for the observed effects. (Author's abstract)
W87-08296

RADIONUCLIDES IN DRINKING WATER: AN OVERVIEW,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 5B.
W87-08307

ESTIMATING THE HEALTH RISKS OF RADON IN DRINKING WATER,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5C.
W87-08308

POINT-OF-ENTRY REMOVAL OF RADON FROM DRINKING WATER,
Maine Univ. at Orono. Dept. of Civil Engineering.
J. D. Lowry, W. F. Brutsaert, T. McEnerney, and C. Molk.
Journal of the American Water Works Association JAWWA5, Vol. 79, No. 4, p 162-169, April 1987. 16 fig, 1 tab, 24 ref. EPA Grant R808724.

Descriptors: *Activated carbon, *Bubble aeration, *Water treatment, *Drinking water, *Water quality, *Radon, Water supply, Filtration, Adsorption, Gamma radiation.

Two processes were investigated in the laboratory to determine their efficiency for removing radon from household water supplies. Granular activated carbon (GAC) adsorption was found to be extremely effective as a result of an adsorption-decay steady state that is established quickly and continues for years. Because bed replacement is not a factor for practical purposes, GAC is the most cost-effective process for radon removal. The GAC bed, however, adsorbs radon progeny as the radon decays, and it becomes a source of gamma radiation. This problem is believed to be manageable for the vast majority of potential applications. Diffused bubble aeration was found to be as effective as GAC, with removals of greater than 99 percent being practical. Although more costly than GAC, aeration does not have the problem of gamma activity buildup. (Author's abstract)
W87-08310

RADIUM REMOVAL USING SORPTION TO FILTER SAND,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
R. L. Valentine, T. S. Mulholland, and R. C. Splinter.
Journal of the American Water Works Association JAWWA5, Vol. 79, No. 4, p 170-176, April 1987. 11 fig, 2 tab, 27 ref. EPA Cooperative agreement CR810575-01.

Descriptors: *Water treatment, *Water quality, *Radium, *Sorption, *Sand filtration, Performance evaluation, Groundwater, Field tests, Iron, Sand, Filters.

This study evaluated the use of a novel sand filtration process that exploits the natural capacity of filter sand to sorb radium through the use of a periodic dilute acid rinse to maintain its sorptive capacity. Batch studies were conducted to determine distribution coefficients so that performance estimates could be made. Laboratory pilot studies using a partially softened groundwater showed the process capable of reducing 226Ra concentrations by 80 to 90 percent in the presence of iron flocs when daily rinsing was practiced using pH 1 (0.35 percent) or pH 2 (0.04 percent) HCl. Similar removals could be achieved in field studies using water containing 9-11 pCi 226Ra/L obtained from the existing sand filters in a city whose supply is treated for iron removal. Removals in the field were less when simultaneous iron and radium removal was attempted. In addition, estimates of the total sorptive capacity of the sand obtained in continuous-flow experiments were generally significantly greater than those predicted based on batch results. (Author's abstract)
W87-08311

PROCEEDINGS OF THE NATIONAL WATER CONSERVATION CONFERENCE ON PUBLICLY SUPPLIED POTABLE WATER.
Dynamac Corp., Rockville, MD.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as PB83-185249. Price codes A20 in paper copy and A01 in microfiche. April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. 492 p.

Descriptors: *Potable water, *Conferences, *Water conservation, *Water quality control, Water supply, Water transport, Water conveyance, Economic aspects, Management planning, Urban planning, Planning.

Papers presented at the National Water Conservation Conference discuss techniques for, and analysis of, potable water conservation and wastewater flow reduction. Papers address such topics as plumbing fixtures, testing and performance of low - flow devices, leak detection and repair, potential problems in wastewater flow reduction, and landscaping with native vegetation. Other subjects are water conservation in rental complexes, enhanced water education, and information and consumer adoption of water conservation measures. Papers on economics examine water pricing systems, analysis of cost/benefits, and development and management of data; papers on planning cover State and local urban planning efforts for conservation and Federal programs and incentives; and case studies present water conservation efforts tried in California, Washington, Utah, Arizona, North Carolina, Maryland, New Jersey, and Massachusetts. (See also W87-08421 through W87-08470) (Author's abstract)
W87-08420

FLOW REDUCTION: METHODS, ANALYSIS PROCEDURES, EXAMPLES,
INTASA, Inc., Menlo Park, CA.
S. L. Postel.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 81-90, 3 fig, 1 tab, 8 ref.

Descriptors: *Wastewater treatment, *Flow reduction, *Evaluation, Water supply, Economic aspects, Handbooks, Cost analysis, Energy costs.

Increasing number of communities across the nation are realizing the benefits of flow reduction in managing their wastewater treatment facilities. Among these benefits are savings in wastewater treatment, water supply and energy costs, as well as the ability to meet a greater portion of future needs with existing treatment capacity. This paper was prepared for the Environmental Protection Agency (EPA) to assist communities in developing cost-effective flow reduction programs. The manual's flexible, yet structured step-by-step procedure is a useful guide to developing program alternatives, analyzing program benefits and costs from a community viewpoint, providing for adequate public participation, and selecting a recommended program based on the analysis results. The manual also provides detailed information on flow reduction measures and specific devices, including their associated costs and water and energy savings, as well as examples of how to calculate a program's net monetary benefits. Two additional volumes will supplement Parts I and II of the manual. Part III will demonstrate the manual's procedures using two real-world communities; Part IV will provide additional guidance and material for developing flow reduction public information programs. (See also W87-08420) (Author's abstract)
W87-08428

WATER CONSERVATION AND WASTEWATER FLOW REDUCTION - IS IT WORTH IT,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W87-08432

EFFECTS OF WATER CONSERVATION ON MUNICIPAL WASTEWATER TREATMENT FACILITIES,
Jefferson Associates, Inc., San Francisco, CA.
For primary bibliographic entry see Field 3D.
W87-08433

MODEL FOR THE TRANSPORT MECHANISMS OF SOLIDS IN BUILDING PIPE DRAINS,
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
L. S. Galowin.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 293-326, 14 fig, 2 tab, 14 ref, append.

Descriptors: *Waste disposal, *Model studies, *Path of pollutants, *Pipes, *Drains, Suspended solids, Mathematical models, Mathematical studies, Flow profile, Flow characteristics, Water conservation.

The requirements for potable water conservation have resulted in the introduction of low water usage devices and plumbing fixtures in buildings. Reductions in the quantity of water discharged into the gravity drainage plumbing system can result in inadequate transport of wastes after entry into the drain pipes. Currently, studies of the transient partially-filled pipe flow with solids in pitched horizontal drains include analytical modeling of the hydraulic/solids interactions and experiments to develop a data base for validation of design methods or empirical correlations applicable to pipe sizing methods for the plumbing drainage system. Initial results from the research on transport mechanisms for solids required for sweeping solids through pitched drain pipes are presented. The modeling parameters and test data for the flow characteristics, solid size, pipe diameter, and pitch of the pipes are discussed. The dependence of the transport phenomena on the depth of the wastewater stream, the length to

diameter ratio of the solids, pitch of the pipe, and wall friction are identified as significant parameters. The computed results from the predictive model for the hydraulic forces are shown to be physically consistent. (See also W87-08420) (Author's abstract)
W87-08452

COMPUTERISED CHECKING OF SURFACE WATER TO BE USED FOR DRINKING PURPOSES,
Azienda Servizi Pubblici Idraulici e Vari, Venice (Italy).
For primary bibliographic entry see Field 5A.
W87-08520

PUBLIC WATER SUPPLY IN NORWAY,
National Inst. of Public Health, Oslo (Norway).
K. Ellingsen, J. M. Raaheim, S. Saegrov, and P. Naess.
Aqua AQUAAA, No. 1, p 32-38, 1987. 2 fig, 6 tab, 2 ref.

Descriptors: *Norway, *Water supply, *Drinking water, *Economic aspects, Surface water, Trenches, Economies of scale, Maintenance, Professional personnel, Pipes.

Although Norway is rich in splendid freshwater resources, and the water supply situation is fairly satisfactory for most of the population, we still have many waterworks low in technical standard and with unsafe supplies. Large towns are generally better off than more rural areas. Many small privately owned waterworks have insufficient water sources and find increasing their tariffs hard to achieve to cover investments in better protection of water sources or in water treatment. Education of waterworks personnel is slowly improving. Many waterworks have remote sources supplying a small number of people. Pipes and the transport of water constitute the main cost factor because of costly deep trenches and the low number of people served. A major problem is the low rehabilitation rate of pipes, resulting in an increasing fear of breakdowns in the water supply transport system in the future if the rehabilitation rate is not substantially increased. (Author's abstract)
W87-08521

REVERSE OSMOSIS PROCESS FOR REMOVING NITRATE FROM WATER,
Hager und Elsaesser G.m.b.H., Stuttgart (Germany, F.R.).
O. K. Marquardt.
Aqua AQUAAA, No. 1, p 39-44, 1987. 7 fig, 4 tab, 31 ref.

Descriptors: *Water treatment, *Reverse osmosis, *Denitrification, Nitrates, Drinking water, Water composition, Biological treatment, Ion exchange, Cellulose acetate membranes.

In the last few years particular attention has been paid to the nitrate content in water. Two physicochemical processes (reverse osmosis (RO) and ion exchange) and one microbiological process (denitrification) are now available. Besides removing nitrate from water, all three processes change the water composition. Alterations in the content of mineral salts, organic substances and microorganisms may occur. These alterations may have a considerable influence on drinking water quality. A good knowledge not only of the treatment capacity of the individual processes but also of the influence which the treatment process may have on the water composition is, therefore, essential for evaluating the various desalination techniques. This paper concentrates on the RO process applied for the removal of nitrate from drinking water and service water and reports on the experience gained in over 5 years' operation with such treatment systems in the beverage industry. Two types of modules used in RO installations (hollow-fibre compact module and spiral-wound module) are evaluated and compared. (Airone-PTT)
W87-08522

RECOVERY OF HIGH-PURITY CALCIUM CARBONATE DURING THE DECARBONIZATION OF DRINKING WATER,
Zweckverband Landeswasserversorgung, Stuttgart (Germany, F.R.).
D. Flinspach, and G. Werner.
Aqua AQUAAA, No. 1, p 45-49, 1987. 5 fig, 1 tab, 2 ref.

Descriptors: *Calcium carbonate, *Drinking water, *Decarbonization, *Water treatment, Costs, Environmental protection.

The Landeswasserversorgung Stuttgart (Stuttgart Regional Water Supply Association) has developed a new type of decarbonization system which is significantly more compact, efficient and reliable in service than previously known plants of this kind. In this context, it is especially important that the new type of system provides for the recovery of calcium carbonate in an ultrapure, industrially usable form during the decarbonization of drinking water. The sale of high-grade calcium carbonate solves the disposal problem and contributes to covering the operating costs of decarbonization. In order to recover calcium carbonate of ultrapure quality, it proved necessary to use repurified lime water instead of lime milk. The lime water is produced via a method which has likewise been recently developed. Using this system, the several hours previously required for the detention period in the reactor can be reduced to approximately 10 minutes. (Airone-PTT)
W87-08523

PROCESSING A RATHER DIFFICULT KIND OF WATER: THE LAKE OF BRET (TRAITEMENT D'UNE EAU DIFFICILE: LE LAC DE BRET),
Service des Eaux de la Ville de Lausanne (Switzerland).
P. Revelly.
Aqua AQUAAA, No. 1, p 50-55, 1987. 4 fig, 3 tab.

Descriptors: *Lake Bret, *Water treatment plants, *Drinking water, *Stagnant water, *Stratification, Water supply, Chemical analysis, Costs, Dissolved oxygen.

Nearly 15% of Lausanne's drinking water is supplied by Lake Bret. Its quality is strongly influenced by its being stagnant year round. The dissolved oxygen content of the lake is particularly low during a large part of the year. Salts of ammonium, iron and manganese also accumulate. Research undertaken in a pilot plant over the last five years has led to the establishment of a complex but effective chain of processing. This chain has been used as the basis for creation of a pumping station which is now nearly operational. The first tests confirm the good quality of the water thus treated. A table shows chemical analysis values for raw and treated water in July, 1986. (Airone-PTT)
W87-08524

INFLUENCE OF THE INITIAL CONCENTRATION OF ORGANIC MODEL COMPOUNDS ON THE RESULTS OF OZONATION (EINFLUSS DER AUSGANGSKONZENTRATION ORGANISCHER STOFFE IM WASSER AUF DIE WIRKUNG DER OZONUNG),
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie.
C. Gauducheau, E. Gilbert, and S. H. Eberle.
Zeitschrift fuer Wasser- und Abwasser Forschung ZWABAQ, Vol. 20, No. 1, p 6-12, February 1987. 11 fig, 3 tab, 23 ref.

Descriptors: *Water treatment, *Ozonation, *Organic compounds, Drinking water, Humic acids, Dissolved solids, Oxidation, Chemical reactions.

The ozonation of isobarbituric acid at initial concentration of .001 mole/l and .00001 mole/l, and at pH = 3, 7, and 12, was investigated in order to evaluate how the results of ozonation of organic compounds at high (c > 100 mg/l) concentration might be transferred to the low concentrations found in raw water for drinking water treatment. At pH 3 the ozonation of isobarbituric acid (c = .001 mole/l) leads to the formation of formyloxaluric acid and oxaluric acid and at pH = 7 to formic acid as well. At initial concentration = .00001 mole/l (pH = 7), besides oxaluric and formic acids, two further products are formed oxalic and alloxanic acid. The carbon balances show that over 90% of the organic oxidation products have been identified. The results of the ozonation of isobarbituric acid at pH 12 as well as of the ozonation in presence of humic acid at pH = 7 and the reaction of isobarbituric acid with Fenton's reagent show that two reaction mechanisms - direct attack of an ozone molecule or reaction of the OH radical - are responsible for the different oxidation products at different conditions. The reaction mechanisms are discussed. To predict the possible oxidation products of a substance in the ozonation step of drinking water treatment (proceeding from the results with pure solutions), it would be useful to examine as well the chief components of the raw water and their reactions with ozone or with radical-degradation products. Ozonation should be observed not only at pH = 7, but in a different pH range as well, in which the reaction is taking place largely through OH radical attack. If in both neutral and basic ranges, no toxic products result, it can be concluded that they will not result in the low-concentration case, either. (Airone-PTT)
W87-08526

CURRENT DPD METHODS FOR DISINFECTANT RESIDUAL MEASUREMENT,
A. T. Palin.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol 40, No. 6, p 501-510, December 1986. 1 fig, 1 tab, 19 ref.

Descriptors: *Analytical methods, *Testing procedures, *Chlorination, *Residual chlorine, *Water treatment, *Disinfection, Chlorinated hydrocarbons, Drinking water, Chemical analysis, Colorimetry, Halogens, Carcinogens, Ozonation, Swimming pools.

The discovery in 1974 that traces of trihalomethanes (THMs) such as chloroform, bromodichloromethane, dibromochloromethane and bromoform could be formed during the disinfection of water by free chlorine has led to a review of the entire subject of water disinfection. Chloroform and the other THMs are suspected of being human carcinogens. Chloramine is a weaker disinfectant than free chlorine, chlorine dioxide produces chlorite and chlorate as by-products, the health effects of which are currently unknown, and ozone produces no residual in the distributed water. Mixed treatments such as chlorine plus chlorine dioxide and ozone plus chlorine are receiving attention. For control purposes, a suitable differential test capable of the separate determination of mixed residuals is essential. Only the diethyl-p-phenylenediamine (DPD) method can meet these further analytical requirements. Full details of the DPD methods covering residual chlorine, chlorine dioxide and chlorite appear in the American Standard Methods and are also available from the USEPA. An outline of the basic DPD methods is given here. In addition, special attention is given to recently developed DPD procedures. (Airone-PTT)
W87-08531

BUDGETING OF WATER DISTRIBUTION IMPROVEMENT PROJECTS,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6C.
W87-08595

STUDY OF WATER TRANSPORTATION TO SAUDI ARABIA,
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Dept. of Civil Engineering.
S. Farooq, and R. I. Al-Layla.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 392-404, May 1987. 5 fig, 2 tab, 17 ref.

Descriptors: *Cost analysis, *Transportation, *Water distribution, *Saudi Arabia, Indus River, Nile River, Euphrates River, Pakistan.

Three regional sources of freshwater around Saudi Arabia are identified; the Indus River in Pakistan, the Nile River in Sudan and Egypt, and the Euphrates and Tigris Rivers in Iraq. Transportation costs are calculated using tanker shuttle service, in which case tankers are used exclusively for the transportation of freshwater between loading and unloading ports. The average water transportation costs from Karachi to Dammam, Port Sudan to Jeddah, and Suez to Jeddah are $0.79, $0.29, and $0.61/ cu m, respectively, in a 300,000-dwt tanker. Reported transportation costs through backhaul service (return cargo) are $1 and $2/cu m at worldscales of 30 and 60, respectively. These costs compare favorably with desalination costs of $1.54-$4.5/cu m in Saudi Arabia. Using these unit costs, four scenarios are discussed for transportation of 910,000 cu m of water/day through different schemes. Water transportation from Pakistan appears to be the most cost-effective of the alternatives and can be made operational at short notice with a small capital investment. (Author's abstract)
W87-08596

5G. Water Quality Control

GREAT LAKES FISHERIES AND ENVIRONMENTAL ISSUES,
Department of Fisheries and Oceans, Owen Sound (Ontario). Great Lakes Fisheries Research Branch.
For primary bibliographic entry see Field 5C.
W87-07632

PHYSIOLOGICAL RESPONSES OF FISH: PROBLEMS AND PROGRESS TOWARD USE IN ENVIRONMENTAL MONITORING,
Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife.
For primary bibliographic entry see Field 2H.
W87-07637

ASSESSING THE HEALTH OF THE OCEANS: AN INTERNATIONAL PERSPECTIVE,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Lab.
J. B. Pearce.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 285-313, 20 fig, 36 ref.

Descriptors: *Water quality, *Monitoring, *Management planning, *Great Lakes, International commissions, Environmental effects, Ecosystems, Water management.

There are a number of points that should be made for any larger body of water, be it Lake Ontario or the Middle Atlantic Bight, when long-term monitoring programs are considered. The first step that should be taken is to assess what is known about the area: what the resources at risk are and how they have been affected; what the natural variables that might affect these resources are; and whether this obscures the impacts of contaminants or physical degradation on the living resources. A number of nations and commissions have taken steps to develop such assessments. For instance, the Helsinki Commission and the ICES requested and obtained an asssessment of the Baltic Sea. This document has been widely used in developing future plans for research and monitoring. In other areas it should be possible to indicate, at the present time, those areas that have been most degraded and that represent 'hot spots' requiring additional research and monitoring. A next important step is for the scientific community to evalute various biological effects monitoring techniques and to implement the ones that appear to have greatest efficacy. Moreover, comparative studies should be done using similar techniques but in different geographic areas and ecological settings. The required quality assurance programs will involve input from a wide range of scientists in many nations. National resources are no longer so large that scientists can work alone and in a vacuum. If a scientist working in the Great Lakes develops a technique that can be used in a generic sense in the oceans or fresh waters, there should be a way of bringing the person's findings to the attention of the scientific community. Finally, once individual scientists are working in concert to solve problems that are common to many aquatic systems, individual agencies and bureaucracies will have to come together to support scientists of several nations that are conducting research that might have generic application. (See also W87-07631) (Lantz-PTT)
W87-07650

STATE OF ECOSYSTEM MEDICINE,
Statistics Canada, Ottawa (Ontario).
D. J. Rapport.
IN: Contaminant Effects on Fisheries, John Wiley and Sons, New York, New York, 1984. p. 315-324, 1 fig, 10 ref.

Descriptors: *Ecosystems, *Stress, *Water quality, Monitoring, Ecological effects, Lake restoration.

In the Environmental Sciences, particularly the study of the behavior of ecosystems affected by various human activities, there is much to be said for the value of an empirical approach rather than a priori generalized theories. There is also the need for a systematic search for patterns in the rapidly accumulating case studies of specific disturbances. This chapter explores an analogy between medicine and the study of the environment, and indicates how concepts derived from the former might provide the means to perceive a more integrated view of ecosystem behavior under stress. These concepts are: (1) symptoms of ecosystems in distress; (2) diagnosis of ecosystem health; (3) treatment protocols for rehabilitation; and (4) preventive ecosystem medicine. Ecosystem medicine is in its infancy. While the signs and symptoms of severely disturbed environments are now reasonably well established, few indicators have been found that provide early warning and diagnositc potential. Diagnosis is further made difficult since many stresses produce the same set of symptoms, and ecosystems are often impacted upon by multiple stresses acting in complex synergistic and occasionally antagonistic modes. In the development of ecosystem practice, much can be learned from medical procedures, especially in the design of treatment protocols, and in recognition of the dangers and risks of various treatment options. (See also W87-087631) (Lantz-PTT)
W87-07651

HAZARDOUS WASTE MANAGEMENT,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5E.
W87-07652

WASTEWATER DISINFECTION: A STATE-OF-THE-ART REPORT.
Water Pollution Control Federation, Alexandria, VA.
For primary bibliographic entry see Field 5D.
W87-07658

RESOURCE IMPACT EVALUATION OF IN-SITU URANIUM GROUNDWATER RESTORATION,
Texas Univ. at Austin. Center for Research in Water Resources.
R. J. Charbeneau, and G. A. Rohlich.
Center for Research in Water Resources Technical Report No. CRWR 184, November 1981. 170 p. 13 fig, 16 tab, 52 ref.

Descriptors: *Water pollution effects, *Groundwater decontamination, *Uranium, *Texas, Mining, Groundwater quality, Ammonium, Carbonates, Bicarbonates, Leaching, Heavy metals, Economic aspects.

The purpose of this study was to determine the impact of restoration on the groundwater following in-situ uranium solution mining in South Texas. Restoration is necessary in order to reduce the amounts of undesired chemical constituents left in solution after mining operations have ceased, and thus return the groundwater to a quality consistent with pre-mining use and potential use. Various restoration strategies have been proposed and are discussed here. Of interest are the hydrologic, environmental, social, and economic impacts of these restoration alternatives. Much of the discussion concerning groundwater restoration is based on the use of an ammonium carbonate-bicarbonate leach solution in the mining process. This has been the principal leach solution used during the early period of mining in South Texas. Recently, because of apparent difficulties in restoring ammonium to proposed or required levels, many of the companies have changed to the use of other leach solutions. Because little is known about restoration with these other leach solutions they have not been specifically addressed in this report. Following a summary of the development of South Texas in-situ mining in Chapter Two, Chapter Three describes the surface and groundwater resources of the uranium mining district. Chapter Four addresses the economics of water use, and Chapter Five is concerned with regulation of the in-situ uranium industry in Texas. A discussion of groundwater restoration alternatives and impacts is presented in Chapter Six. Chapter Seven contains a summary and a discussion, and conclusions derived from this study. (Lantz-PTT)
W87-07659

WATER: TOO MUCH, TOO LITTLE, TOO POLLUTED,
A. Goldin.
Harcourt Brace Jovanovich, Publishers, San Diego, California, 1983. 229 p.

Descriptors: *Water resources development, *Water management, *Water pollution prevention, *Water yield improvement, *Water supply development, *Water quality management, Water use efficiency, Desalination, Cloud seeding, Irrigation efficieny, Water demand, Water supply, Water conservation, Water treatment, Water reuse.

Access to low-cost fresh water is likely to become the global problem of the eighties. To ensure that water will be available when and where it is needed, wise management of the resources and efficient utilization of the supply is mandated. The sophisticated technology being used to discover new sources, to filter the water, to pump it to the point of use, and to reclaim it for secondary purposes are discussed. Water scientists and engineers are working to increase the supply of fresh water by seeding clouds to produce rain, by desalting brine in increasingly more economical ways, and by devising methods of contour plowing, no-till agriculture, and computerized drip irrigation to prevent runoff and evaporation. Biologists and botanists are hybridizing high-yielding food and fiber plants that are drought-resistant and/or salt-tolerant. The practical assistance being provided by the United Nations to underdeveloped countries as part of its 1981-1990 International Drinking Water Supply and Sanitation Decade is outlined. (Geiger-PTT)
W87-07679

WATER: A BASIC RESOURCE,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 6D.
W87-07681

GROUNDWATER TREATMENT TECHNOLOGY,
DETOX, Inc., Dayton, OH.
E. K. Nyer.
Van Nostrand Reinhold Company, New York. 1985. 188 p.

Descriptors: *Groundwater pollution, *Groundwater management, *Water treatment, *Organic compounds, *Water pollution treatment, Biological treatment, Physicochemical treatment, Adsorption, Heavy metals, Nitrates, Dissolved solids, Separation techniques, Inorganic compounds, Case studies.

Methods for applying new technologies and engineering techniques to groundwater decontamination are presented. Design, operation, safety, and cost data are included for each method. Comparisons between wastewater and groundwater treat-

ments show the unique requirements of groundwater cleanup. Among the cleanup techniques examined are: physical/chemical methods for organic contaminant removal including design and application methods for pure compound removal, air stripping, and carbon adsorption; biological methods for organic contaminant removal including traditional treatment systems and specific treatment systems for groundwater treatment; treatment methods for inorganic contaminants including heavy metals, nitrates, and totally dissolved solids; in-situ methods for organic contaminants including aquifer and unsaturated zone clean-up. Five case studies examine implementation strategies used in removing gasoline, phenol, isopropanol, TSE, general volatile organic compounds, and other contaminants from groundwater supplies. Methods for decontaminating complex aquifer systems are presented. This book is intended for use by wastewater engineers, hydrologists, soil experts, civil engineers, chemical engineers and industrial and government managers that oversee groundwater cleanups. (Geiger-PTT)
W87-07701

FRAGMENTATION AND INTEGRATION IN STATE ENVIRONMENTAL MANAGEMENT,
Conservation Foundation, Washington, DC.
B. G. Rabe.
The Conservation Foundation, Washington, DC. 1986. 174 p.

Descriptors: *Water pollution control, *Water pollution prevention, *Water quality management, *Governmental interrelations, *Project planning, Institutional constraints, Water policy, Water management, Interagency cooperation, Local governments, State jurisdiction, Federal jurisdiction.

The ongoing trend toward fragmentation in state and federal environmental management is explored, and past efforts at both the state and federal levels to bring greater coherence to the overall system of pollution control are examined. Three states that have attempted far-reaching efforts to integrate their pollution control programs are examined: Illinois, New York, and Washington. An examination of how these innovations were started and an evaluation of how well they have worked are presented. In general, the innovations are successful because they transcend medium boundaries and establish new institutions or procedures that foster greater integration without precluding a manageable transition from past practices. The long-term prospects for integration at both the state and federal levels are discussed along with avenues for promoting integration. (Geiger-PTT)
W87-07721

REPORT OF THE AQUATIC ECOSYSTEM OBJECTIVES COMMITTEE: 1985 ANNUAL REPORT.
International Joint Commission-United States and Canada, Windsor (Ontario). Standing Committee on the Scientific Basis for Water Quality Criteria. Great Lakes Science Advisory Board, Report to the International Joint Commission, February 1986, Windsor, Ontario. 119 p, 1 fig, 11 tab, append.

Descriptors: *Water quality control, *Water quality management, *Water quality standards, *Bioindicators, *Great Lakes, Trout, Ammonia, Fish, Chlorinated hydrocarbons, Research priorities, Ecosystems, Oligotrophic lakes, Water pollution effects, Ecological effects.

Various revisions to the Great Lakes Water Quality Agreement that were recommended by The Aquatic Ecosystem Objectives Committee are discussed. The waters should be maintained and restored to a condition where a balanced and stable community of organisms is present which resembles the community that existed before human intervention. Lake Superior should be maintained as a balanced and stable oligotrophic ecosystem with the lake trout as top aquatic predator of a cold-water community. Concentrations of un-ionized ammonia in water must not exceed 0.03 milligrams per liter for the protection of aquatic life. The concentration of lindane in water should not exceed 0.02 micrograms per liter for the protection of aquatic life. The concentration of lindane in edible portions of fish should not exceed 0.3 micrograms per gram (wet weight basis) for the protection of human consumers. The concentration of toxaphene in water should not exceed 0.0002 micrograms per liter for the protection of human consumers. More research is needed in the areas of community structure and function, Lake Erie fish communities, sediments as a source of toxic chemicals, metal speciation, air sampling methodology, epidemiology, environmental mapping quantitative structure-activity relationships, toxic effects of mixtures, mixing/limited use zones, and persistence. In addition, more data is needed for the following chemicals: diazinon, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, heptachlor and its epoxide, DDT, phthalates, organotins, dieldrin, chlordane, mirex, silver, manganese, molybdenum, vanadium, ammonia, chlorine, oxygen, pentachlorophenol, dioxins, lead, chromium, mercury, polychlorinated styrenes, asbestos, guthion, malathion, and toxaphene. (Geiger-PTT)
W87-07724

INTERNATIONAL JOINT COMMISSION: 1983-1984 ACTIVITIES REPORT.
International Joint Commission-United States and Canada, Windsor (Ontario).
For primary bibliographic entry see Field 6E.
W87-07725

UNITED STATES MARINE WASTE DISPOSAL POLICY,
National Oceanic and Atmospheric Administration, Washington, DC. Office of General Counsel.
E. Erdheim.
IN: Wastes in the Ocean, Volume 6: Nearshore Waste Disposal, John Wiley and Sons, New York, New York. 1985. p 421-460, 3 tab, 119 ref.

Descriptors: *Coastal waters, *Ocean dumping, *Waste disposal, *Legislation, Policy making, Public policy, Industrial wastes, Marine environment, Legal aspects, Regulations.

United States marine waste-disposal policy in the early 1970s was based on minimizing, if not eliminating, waste disposal in the marine environment. The Ocean Dumping Act prohibits any dumping that unreasonably degrades the marine environment. The U.S. Environmental Protection Agency (EPA) interpreted the act to require the phasing out of ocean dumping of sewage sludge and industrial waste. The Clean Water Act established a goal of no discharge for 1985. This act also established a multifaceted program, based largely on technologically established effluent standards, to achieve the act's objective of restoring and maintaining the chemical, physical, and biological integrity of U.S. waters. Recently, U.S. policy has evolved to allow utilization of the oceans for waste disposal. A report by the U.S. National Advisory Committee on Oceans and Atmosphere recommended that the waste-disposal policy of the 1970s be changed to utilize the assimilative capacity of the marine environment to dispose of wastes under certain conditions. A federal court determined in 1981 that the EPA's interpretation of the Ocean Dumping Act to require the phasing out of ocean dumping that unreasonably degraded the environment. The Clean Water Act was amended in 1977 to allow waivers of the technologically based secondary treatment requirement for publicly owned treatment works under certain conditions. Finally, laws such as the Resource Conservation and Recovery Act and the Clean Air Act have made waste disposal on land and in the atmosphere more difficult, thus forcing a reevaluation of the policy of not using the marine environment for waste disposal. The marine environment is likely to be used for waste disposal to a greater extent in the future. The health of the marine environment will depend on effective implementation and integration of the Ocean Dumping Act and the Clean Water Act. For the long term, the United States needs to develop a comprehensive waste-disposal policy that results in wastes being disposed of in the environmental medium of least risk to human health and to the environment. Such a policy also must ensure that special protection be afforded to environmental media, such as the marine environment, that are not adequately protected by political and economic forces. (See also W87-07729) (Author's abstract)
W87-07747

SEWAGE-SLUDGE DUMPING IN THE NEW YORK BIGHT APEX: A COMPARISON WITH OTHER PROPOSED OCEAN DUMPSITES,
National Oceanic and Atmospheric Administration, Stony Brook, NY. Office of Sea Grant.
For primary bibliographic entry see Field 5E.
W87-07748

FUTURE STRATEGIES FOR NEARSHORE WASTE DISPOSAL,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W87-07749

CONTROL OF THE WATER QUALITY OF SPA (LE CONTROL DE LA QUALITE DES EAUX DE SPA.),
R. Verbruggen.
Aqua AQUAAA, No. 6, p 349-350, 1986.

Descriptors: *Mineral water, *Water quality control, Spa region.

In the Spa region two types of mineral waters can be found which have many medical benefits. The water's acratopeges have very little mineralization with traces of undesirable ions such as, nitrates, and the water's pouhon which are rich in manganese, carbonic acid, and iron. The low mineralization of these water are due to the low solubility of the minerals present in the quartz lining of the water source and the natural uncontaminated flora around the water sources. Also these water sources are protected from fecal microorganisms from farm animals and hence free from large amounts of ammonia and nitrate ions. The sanitary control of this water industry begins at the source of reservoir and continues through packaging and transportation operations. Beginning with weekly tests at the source using sabouraud for germs in general and tryptone Agar for fecal bacteria in particular to similar daily tests in the resevoir itself as well as other special plaque-filtering techniques to daily examinations of the bottles and corks, and ending with final inspections of the finished products, guarantees purity of the product. Advanced detection programs for all types of known bacteria, special care in sterilization, and 1800 total analyses per week result ultimately in clean water. (Ray-PTT)
W87-07791

CLEAN WATER ACT RETURNS,
R. Rhein.
Chemical Week CHWKA9, Vol. 140, No. 3, p 17, January 1987.

Descriptors: *Clean Water Act, *Legislation, *Publicly owned treatment works.

A $20 billion Clean Water Act reauthorization bill provides: (1) an $18 million authorization of federal grants for municipal wastewater treatment plants; (2) new authorization for the Environmental Protection Agency to impose administrative civil penalties; (3) regulation of industrial stormwater discharges; and (4) a new compliance date for organic chemical effluent guidelines. EPA can now impose a two-tier system of administrative penalties in civil actions against companies operating their own wastewater treatment facilities that fail to meet federal regulations. A new permitting program will be established to control industrial and municipal stormwater discharges as point sources of pollution. (McFarlane-PTT)
W87-07817

MICROBIOLOGICAL QUALITY OF BOTTLED WATER SOLD IN CANADA,
Helath and Welfare Canada, Ottawa (Ontario). Food Directorate.

D. W. Warburton, P. I. Peterkin, K. F. Weiss, and M. A. Johnston.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 11, p 891-893, November 1986. 2 tab, 17 ref.

Descriptors: *Microbiological studies, *Bottled water, *Water analysis, *Water quality, Bacterial analysis, Contamination.

Within the last few years, there has been an increase in the consumption of bottled water in North America, prompted by concern over increasing water pollution, by offensive tastes or odors from municipal water supplies, by objection to fluoride, chlorine, and other additives, and by the public's unquestioning apperception of good quality in bottled water since it usually derives from a spring or underground source. By legal definition, water represented as mineral or spring water is a potable water obtained from an underground source, but not from a public water supply, and should not contain any coliform bacteria. Other bottled waters (termed water in sealed containers) may undergo a variety of treatments if labelled accordingly and should not contain any coliform bacteria nor more than 100 aerobic bacteria per milliliter. The microbiological quality of bottled water sold in Canada was evaluated. A total of 114 lots of bottled water, both domestic and imported, were analyzed for aerobic colony count, coliforms, fecal coliforms, and Escherichia coli. No fecal coliforms or E. coli were found. Nineteen (41%) of the 41 lots of domestic purified water were found to exceed aerobic colony count standards and another lot exceeded coliform standards. One lot each of domestic and imported mineral water exceeded coliform standards. If mineral water were governed by the aerobic colony count standards for bottled water, then 5 lots each of both domestic and imported mineral water would have been found to be unsatisfactory. More surveillance of the bottled water industry in Canada is recommended. (McFarlane-PTT)
W87-07818

IMPROVED MANAGEMENT SYSTEMS A MUST,
Camp, Dresser and McKee, Inc., Boston, MA.
P. Hersch.
Water Engineering and Management WENMD2, Vol. 134, No. 1, p 12, 38, January 1987.

Descriptors: *Management planning, Water treatment, Wastewater treatment, Regulations, Law enforcement, Operating policies.

Noncompliance of water and wastewater treatment plants with existing regulations is a persistent management problem. Many facilities are hardly managed at all, resulting in high operating costs, near-constant internal friction and bickering, poor morale, operational delays, missed schedules, and backups due to management's indecisions, myriad mistakes, and absence of assigned responsibilities or accountability. In general the problem is usually due to lack of systematic, thought-through, well-prepared, formal management procedure. The first step in management improvement is to define each of the management functions underlying the operations of a particular water or wastewater utility, such as personnel management, process-control management, maintenance management, purchasing management, financial management, and information-system management. The resulting list should be ordered for priority-order attention. The second step is to name the objectives for each of these management activities and the procedures needed to achieve them, making sure that all individual objectives are consistent with the utility's objective, and that all elements involved, even if only peripherally, in the management activities are included. A critical part is pinpointing the true objective. The third step is to document the new or improved management procedures as completely, but as simply and directly, as possible. The fourth step consists of implementing the new methods, using a two-part process. One part takes account of changes needed for corrective actions; the other accounts for training personnel who are directly affected and for informing all others. (McFarlane-PTT)
W87-07827

STATISTICAL METHODS FOR CHARACTERIZING GROUND-WATER QUALITY,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
J. Harris, J. C. Loftis, and R. H. Montgomery.
Ground Water GRWAAP, Vol. 25, No. 2, p 185-193, March-April 1987. 5 fig, 4 tab, 11 ref. DOI Grant 14-08-0001-1060.

Descriptors: *Water quality data, *Data collections, *Monitoring, *Groundwater, *Groundwater management, *Statistical methods, *Groundwater pollution, *Statistical analysis, *Statistics, Quality control, Mathematical studies, Seasonal variation, Time series analysis, Distribution graphs, Water pollution control, Monitoring, Water management, Water quality, Periodograms, Student's t-test, Mann-Whitney test, Analysis of variance, Kruskal-Wallis test, Correlation coefficient.

The benefits from groundwater quality monitoring ultimately depend on the statistical methods used to analyze data. The methods must match both the information expectations of users and the characteristics of the water quality variables to which they are applied. The primary objective of regulatory groundwater monitoring is detecting changes in quality. To select appropriate statistical tests for change, one must know whether the water quality variables of concern are seasonal, normally distributed, and serially dependent. Guidance is provided in analyzing limited background data sets to determine these three characteristics. Recommended procedures to detect seasonality were periodograms, Student's t-test, Mann-Whitney test, analysis of variance, and Kruskal-Wallis test. To test for normality, the skewness coefficient is recommended. To detect serial dependence, sample autocorrelation coefficients may be tested for significance. (See also W87-07852) (Author's abstract)
W87-07853

FAST TRACKING TO WATER QUALITY,
Espey, Huston and Associates, Inc., Austin, TX.
For primary bibliographic entry see Field 5D.
W87-07928

CAN A SMALL TOWN TREATMENT PLANT ESTABLISH NEW STANDARDS,
For primary bibliographic entry see Field 5D.
W87-07938

HIGH TECH APPROACH TO URBAN STORMWATER MANAGEMENT,
Austin Dept. of Public Works, TX. Watershed Management Div.
D. V. Pimentel, and G. E. Oswald.
Public Works PUWOAH, Vol. 117, No. 12, p 32-34, December 1986.

Descriptors: *Urban runoff, *Storm runoff, *Watershed management, *Stormwater, *Drainage programs, *Water quality management, *Austin, Texas, Runoff, Watershed management, Urbanization, Urban drainage, Runoff volume, Wastewater management, Storm water, Flooding, Economic aspects, Financing, Planning, Management planning, Regional planning, Monitoring, Erosion control, Automation, Remote sensing, Computers, Data collections, Data processing.

Austin, TX has adopted innovative solutions to the increasingly complex issues of urban stormwater management. These solutions are reviewed; they include funding, scheduled drainage facility maintenance planning, stormwater quality monitoring, erosion and sedimentation control measures, an automated water quality data base, a remote sensing and geographical information system, regional stormwater detention planning, a floodplain information center, and a flood early warning system. Each of these involves some or all of the various aspects of the following: planning; data collection, storage, retrieval, analysis, and forecasting; regulation; public information; and public review. Future plans include increased automation of the city's watershed management endeavors. (Doria-PTT)
W87-07939

SERVICE ACTIVE IN CHESAPEAKE RESTORATION,
Ecological Services, Annapolis, MD.
S. Funderburk.
Fish and Wildlife News, p 20-21, April-May 1986.

Descriptors: *Chesapeake Bay, *Administrative agencies, *Estuarine environment, *Conservation, *Environmental policy, Environment, Estuaries, Fish, Waterfowl, Habitats, Wildlife habitats, Bass, Geese, Water pollution, Water pollution effects, Wildlife conservation, Vegetation, Aquatic plants, Mollusks, Assays, Bioassays, Standards, Water quality standards, Water quality management, Mapping, Surveys, Education, Public policy, Social aspects.

The U.S. Fish and Wildlife Service is participating in a multimillion dollar federal and state effort to restore the Chesapeake Bay, whose wildlife populations have been reduced by water pollution (primarily from nutrient enrichment, but also toxic chemicals). A number of separate restoration missions are being undertaken to restore many of the important resources of the bay. Projects include: (1) water quality data collection on the Choptank River to identify agricultural areas in need of best management practices for reducing nutrient runoff; (2) a study of four industrial discharge sites to determine effluent effects on aquatic life; (3) aerial photography and mapping of aquatic vegetation; (4) development of public education materials; and (5) striped bass hatchery production and tagging. (Doria-PTT)
W87-08009

WATER REGULATIONS AND THE DIRECTION OF THE EPA,
Environmental Protection Agency, Dallas, TX. Region VI.
M. O. Knudson.
Southwest and Texas Water Works Journal STWJDV, Vol. 69, No. 1, p 4-9, April 1987.

Descriptors: *Drinking water, *Water quality management, *Legislation, *Environmental Protection Agency, Legal aspects, Law enforcement, Regulations, Safe Drinking Water Act, Water Quality Act.

Details of the June 1986 amendments to the Safe Drinking Water Act which requires every public water supply in the USA to meet the primary drinking water regulations were presented. The new amendments state that: (1) the EPA must regulate nine contaminants within a year of enactment, another 40 within two years, and another 34 within three years for a total of 83, (2) Congress has specified the 83 contaminants but the EPA has the option of substituting up to seven other contaminants for those on the list if that will provide greater health protection, (3) in addition to the 83, at least 25 more primary standards will be required by 1991 and 25 more standards every three years thereafter, (4) within 18 months of enactment of the law the EPA must promulgate regulations specifying criteria under which filtration is a required treatment technique and states will have four years to comply, and (5) by June 1988 the EPA must promulgate regulations requiring disinfection and specifying criteria that will be used to grant The impacts of the major policy changes included in the Water Quality Act of 1987 on the environment, the EPA, and state and local governments were discussed. The EPA expects to continue cooperating with state and local governments on compliance with the laws and to continue emphasizing water and wastewater programs. (Wood-PTT)
W87-08068

ROLE OF RIVERBANK FILTRATION ALONG THE RHINE RIVER FOR MUNICIPAL AND INDUSTRIAL WATER SUPPLY,
Technische Univ. Hamburg-Harburg (Germany, F.R.).
P. A. Wilderer, U. Forstner, and O. R. Kuntschik.
IN: Artificial Recharge of Groundwater, Butter-

worth Publishers, Boston, Massachusetts. 1985. p 509-528, 7 fig, 6 tab, 41 ref.

Descriptors: *Surface-goundwater relations, *Bank filtration, *Filtration, *Rhine River, *Municipal water, *Industrial water, *Germany, *Water quality control, Water supply development, Water supply, Salts, Organic compounds, Heavy metals.

In the Rhine River basin in Germany, riverbank filtration has been practiced widely for decades to meet water demands for population and industry. Until the late 1950s, the quality of the mixture of bank filtrate and natural groundwater was satisfactory for potable water, and thus, no additional water treatment was required. Due to the increasing water pollution in the Rhine River since then, serious water quality problems have developed. Plugging of the filter inlet zone occurred. Salt, trace organics, and heavy metals are pollution categories of major concern. In additional, iron and manganese remobilization, caused by enhanced reducing conditions in the filter body, harmfully impacts on the water quality. As a result, advanced water treatment systems must be installed, which could result in tremendous treatment costs. Utility companies are switching more and more to alternative water sources, such as impoundment of nonpolluted rivers and even artificial groundwater recharge using pretreated water. These increasing water quality problems may be managed by water treatment. However, the more effective policy to meet the increasing water demands is to protect the water supply sources via riverwater pollution control. Programs sponsored by the state and the federal governments have already proved to be effective. The Rhine River is gradually improving, even though conditions there are still beyond the tolerable level. (See also W87-08137) (Lantz-PTT)
W87-08153

BANK AND DUNE INFILTRATION OF SURFACE WATER IN THE NETHERLANDS,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands). Lab. of Organic Chemistry.
G. J. Piet, and B. C. J. Zoeteman.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 529-540, 1 fig, 8 tab, 7 ref.

Descriptors: *Artificial recharge, *Infiltration, *Groundwater recharge, *Netherlands, *Surface water, *Groundwater quality, Surface-groundwater relations, Water supply development, Water quality.

The Netherlands currently uses about 1,900 million cu m of water/yr for its drinking water supply. About 60% of this water comes from groundwater, and about 40% from surface water. In the populous western part of the country near the coast, where the provinces of North and South Holland and the cities of Amsterdam, The Hague, and Rotterdam are located, the groundwater is generally insufficient. The drinking water supply in this area is largely dependent on surface water that is put through an open infiltration system. Pretreated riverwater, which undergoes chlorination during summer, is introduced into the coastal dunes by means of canals and open ponds and is then allowed to filter through the soil before extraction. Until the 1960s, artificial recharge of groundwater was considered to be primarily a hydrologic and physical process. Chemical considerations were limited to such transformations of inorganic compounds as nitrification and denitrification. Even after the seriousness of river contamination with hundreds of industrial chemicals was recognized, only limited attention was geiven to the behavior of these chemicals during infiltration of river water in the soil. The current application of advanced analytical techniques is shedding new light on the potential of the infiltration process to remove chemical compounds from polluted raw waters and on the possible dangers of soil contamination in the recharge area. With these new insights, the reaction of organic chemicals during the passage of water through the soil has gained not only a scientific but also a political impact. This chapter discusses the use of infiltration systems in The Netherlands and then explores the behavior of individual organic chemicals during the infiltration process under field conditions. This approach lends to a number of hypotheses on the behavior of individual compounds during infiltration that need to be further verified by model studies under laboratory conditions. Finally, recommendations for further research in this respect are given. (See also W87-08137) (Lantz-PTT)
W87-08154

RESEARCH FOR GROUNDWATER QUALITY MANAGEMENT,
Robert S. Kerr Environmental Research Lab., Ada, OK.
For primary bibliographic entry see Field 4B.
W87-08163

RIVER WATER QUALITY MONITORING,
Oklahoma Univ., Norman. Environmental and Ground Water Inst.
For primary bibliographic entry see Field 7A.
W87-08165

EFFECT OF RCRA ON THE CHEMICAL INDUSTRY,
Chemical Manufacturers Association, Washington, DC.
J. J. Mayhew.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 7-12.

Descriptors: *Chemical industry, *Environmental effects, *Legislation, *Waste disposal, Waste management, Regulations, Hazardous wastes, Research needs.

The Resource Conservation and Recovery Act (RCRA) of 1976 has had a major effect on the way the chemical industry treats and disposes of its wastes. In 1980 and 1981 the U.S. Environmental Protection Agency (EPA) promulgated regulations that place stringent controls on the handling of hazardous wastes. These regulations have both favored certain types of treatment and disposal and provided the economic incentive to modify manufacturing processes that minimize the production of residuals that must be discarded. This chapter describes the results of an informal survey of several major chemical companies to determine what specific changes in hazardous waste handling practices have occurred since the promulgation of the regulations, and what long-term trends in generation and disposal are expected. The survey includes information on research needs, shifts in methods of disposal, and short-term solutions in response to regulatory and scientific uncertainty concerning acceptable methods of disposal. (See also W87-08166) (Author's abstract)
W87-08167

REMEDIAL ACTIONS AT SOLID WASTE LANDFILLS,
Wehran Engineering Corp., Middletown, NY.
For primary bibliographic entry see Field 5E.
W87-08195

ANALYSIS OF SEPTIC TANK DISTRIBUTION AND SEPTAGE GENERATION RATES IN ILLINOIS,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
For primary bibliographic entry see Field 5D.
W87-08218

COMMUNITY WATER SUPPLY IN DEVELOPING COUNTRIES: LESSONS FROM EXPERIENCE, EVALUATION SUMMARIES AND CONFERENCE FINDINGS,
Agency for International Development, Washington, DC.
For primary bibliographic entry see Field 5F.
W87-08234

RADIONUCLIDES IN DRINKING WATER: AN OVERVIEW,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 5B.
W87-08307

EVALUATION OF A GROUNDWATER CORRECTIVE ACTION AT THE CHEM-DYNE HAZARDOUS WASTE SITE USING A TELESCOPIC MESH REFINEMENT MODELING APPROACH,
GeoTrans, Inc., Herndon, VA.
D. S. Ward, D. R. Buss, J. W. Mercer, and S. S. Hughes.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 603-617, April 1987. 18 fig, 1 tab, 22 ref.

Descriptors: *Water pollution treatment, *Path of pollutants, *Groundwater pollution, *Model studies, Geohydrology, Plumes, Pollutants, Waste disposal, Regional analysis, Infiltration.

The available data base and hydrogeologic information for the Chem-Dyne hazardous waste site, located in southwestern Ohio, are typical of many Superfund sites. Data are localized because investigations conducted at these sites are for the purpose of defining contaminant plumes. Little or no data are available to characterize the regional flow systems which impart a controlling influence on the rate and direction of contaminant migration. To simulate groundwater flow and contaminant transport in this setting, a telescopic mesh refinement (TMR) approach is appropriate. This approach provides the means of accurately incorporating regional controlling factors into smaller model domains and also increased grid resolution in areas of critical importance. At the Chem-Dyne site a finite-difference model was applied at three scales: regional, local, and site. This application of TMR integrates the regional and local flow system characteristics to analyze the effectiveness of a proposed remedial action at the site scale. The TMR modeling approach permits effective flow and transport model construction and calibration to provide quantitative analysis of system response to a groundwater extraction-injection well clean-up system. Calibration of the flow models demonstrates the regional importance of induced river infiltration to groundwater pumping centers and the control of surface water features on the direction of plume migration. The site-scale transport model reveals that a significant portion of the volatile organic contaminants are not captured by the preliminary proposed system. (Author's abstract)
W87-08337

ANNUAL EFFLUENT AND ENVIRONMENTAL MONITORING REPORT FOR CALENDAR YEAR 1981.
Bettis Atomic Power Lab., West Mifflin, PA.
For primary bibliographic entry see Field 5B.
W87-08361

LEACHING EVALUATION OF AGRICULTURAL CHEMICALS (LEACH) HANDBOOK,
Anderson-Nichols and Co., Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5B.
W87-08362

PROCEEDINGS OF A SEMINAR ON ATTAINING WATER QUALITY GOALS THROUGH WATER MANAGEMENT PROCEDURES.
Hydrologic Engineering Center, Davis, CA.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-123874. Price codes A13 in paper copy and A01 in microfiche. February 17-18, 1982, Dallas, Texas. 271 p.

Descriptors: *Water resources development, *Water management, *Resources management, Water quality control, Water quality, Resources development, Water sampling, Water use, Aquatic environment, Lakes, Reservoirs.

Various aspects of attaining water quality goals through water management procedures are presented in a series of 28 papers. General subjects

covered include evaluation of water quality impacts, water quality program management, reservoir water quality data collection, laboratory analysis, data management, data interpretation, sampling design, modeling capability, water quality modeling, water control, disposal of contaminated wastes, ocean dumpling, Mt. St. Helens recovery operation, salinity response in San Francisco Bay, turbine venting, and management of water quality at specific dams and reservoirs. (See also W87-08366 thru W87-08390) (Halterman-PTT)
W87-08365

EVALUATION OF WATER QUALITY IMPACTS FROM WATER RESOURCES MANAGEMENT PROGRAMS AND PROJECTS,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
L. W. Canter.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 4-29, 3 fig, 10 tab, 57 ref.

Descriptors: *Water resources development, *Water management, *Resources management, Water quality control, Water quality, Resources development, Water sampling, Water use, Runoff, Aquatic environment, Ecosystems, Lakes, Reservoirs, Multipurpose reservoirs, Reservoir operation, Mitigation, Environmental effects.

An evaluation of water quality impacts including those resulting from water resources management programs and various projects, such as multipurpose reservoirs and industrial complexes, is discussed. Specifically, a systematic approach to identifying and evaluating water quality and quantity-related impacts of water resources management programs is presented. A conceptual framework for addressing water pollution impacts is outlined, and specific information associated with each of the framework elements is summarized. The suggested framework includes the following elements: identification of impact-causing factors, description of baseline conditions, calculation of anticipated impacts, assessment of calculated impacts, identification and evaluation of mitigation measures, and preparation of study documentation. Examples of scientific approaches for accomplishing the various elements of the conceptual framework are also included. The ability to predict and assess water quality impacts by applying existing technologies is discussed. (See also W87-08365) (Halterman-PTT)
W87-08366

WATER QUALITY PROGRAM MANAGEMENT,
Corps of Engineers, Huntington, WV. Huntington District.
G. P. Kincaid.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 30-34.

Descriptors: *Water resources development, *Water management, *Resources management, Water quality control, Water quality, Environmental effects, Aquatic environment, Water use, Ecosystems, Reservoirs.

Various aspects of attaining water-quality objectives are presented, with a focus on Corps of Engineers program management at the district level. The importance of a case-by-case approach to investigations is discussed. General criteria for evaluating the adequacy of sampling scope and methods include: impact identification, impact measurement, impact interpretation, and impact quantification. The ultimate objectives and priorities of a program are predicated on these and other criteria, including: the significance of given impacts or issues, the resources available to further evaluate given impacts, the alternative action available to either mitigate or eliminate the impacts, the probability of a given impact's occurrence and the resulting damage or loss, and administrative constraints. (See also W87-08365) (Halterman-PTT)
W87-08367

ENVIRONMENTAL AND WATER QUALITY OPERATIONAL STUDIES (EWQOS) - STATUS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. L. Mahloch.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 35-39, 1 tab.

Descriptors: *Water quality control, *Water quality, *Environmental effects, Aquatic environment, Resources development, Planning, Resource management, Water sampling, Technology transfer.

A program to provide research and development, and a program of technology transfer to solve high priority environmental problems associated with water resources development, are discussed. The conduct of the program ensures that results are technically sound and are founded on sufficient data obtained by field studies of operational projects. Review and coordination procedures established will ensure that planning, design, construction and operational procedures developed will be compatible with project purposes, minimize constraints and conflicts, and promote sound water resource development. Finally, technology transfer ensures that information provided to field offices will be useful, cost effective, and meet needs through application and feedback on program results. (See also W87-08365) (Halterman-PTT)
W87-08368

APPLICATION OF DATABASE MANAGEMENT TECHNIQUES TO RESERVOIR WATER QUALITY STUDIES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 7C.
W87-08374

ONE AND TWO DIMENSIONAL WATER QUALITY MODELING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
D. L. Robey, and A. B. Stein.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedure, February 17-18, 1982, Dallas, Texas. p 108-113, 14 ref.

Descriptors: *Model studies, *Mathematical models, *Model testing, Water resources development, Water management, Water quality control, Water quality, Resources development, Environmental effects.

Water quality models being developed within the Corps of Engineers' Environmental and Water Quality Operational Studies (EWQOS) program, for reservoir and riverine areas, are discussed. A major objective of the EWQOS is the development of water quality models specifically for use by Corps of Engineers Division and District engineers and scientists. Emphasis has been placed on obtaining the required field and laboratory data to form a better understanding of water quality processes and also provide information for verification of models. The models described include CE-QUAL-RI, CE-THERM-R1, CE-QUAL-R2, and CE-QUAL-RV2. The use of these models to improve the Corps of Engineers credibility in the area of water quality modeling and increase the acceptability of results is discussed. (See also W87-08365) (Halterman-PTT)
W87-08375

RIVER AND RESERVOIR SYSTEMS WATER QUALITY MODELING CAPABILITY,
Hydrologic Engineering Center, Davis, CA.
R. G. Willey.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 94-107, 8 fig, 1 tab, 12 ref.

Descriptors: *Model studies, *Mathematical models, Water resources development, Water management, Water quality control, Water quality, Resources development, Environmental effects.

Early water quality mathematical models are briefly described and the evolution of modern state-of-the-art mathematical models is discussed. Several models are presented which provide an excellent package of programs to meet many of the normal needs for one-dimensional modeling capability. Specific types of models presented include those for reservoir temperature analysis, river-reservoir ecological analysis, and reservoir system water quality analysis. (See also W87-08365) (Halterman-PTT)
W87-08376

WATER CONTROL STRATEGIES,
Corps of Engineers, Dallas, TX. Southwestern Div.
For primary bibliographic entry see Field 6D.
W87-08378

EXPERIENCE OF THE ST. PAUL DISTRICT, CORPS OF ENGINEERS, WITH STATE COORDINATION OF DREDGING ACTIVITIES,
Army Engineer District, St. Paul, MN.
R. J. Whiting.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 143-149.

Descriptors: *Water quality control, *Water quality, *Dredging, Spoil banks, Aquatic environment, Environmental effects, Legal aspects, Mississippi River.

Various aspects of coordinating dredging activities along the Mississippi River are discussed. Lawsuits concerning environmental impact statements; allowable dredging depth; the Clean Water Act of 1977 as it applies to some aspects of dredging; maintenance dredging, specifically regarding permit exceptions and variances; water quality impacts; and compliance with state standards including Minnesota, Wisconsin and Iowa are described. The basic issue addressed is the question of whether discharge from upland dredged material containment sites are regulated by the NPDES permit program of Section 402 of the Clean Water Act, or as a continuation and therefore, part of the disposal of dredged material and thus regulated by Section 404 of the Clean Water Act. (See also W87-08365) (Halterman-PTT)
W87-08382

DISPOSAL OF HIGHLY CONTAMINATED DREDGE MATERIAL,
Army Engineer Div. North Atlantic, New York.
R. J. Pierce.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 150-176, 3 fig, 11 tab, 35 ref.

Descriptors: *Ocean dumping, *Dredging, Water resources development, Water management, Water quality, Aquatic environment, Environmental effects, Benthos, Bioassays, Bioaccumulation.

The approach developed by the Corps of Engineers to address the question of ocean dumping of New York Harbor dredge material is discussed. Liquid and suspended particulate phase bioassays, using phytoplankton, zooplankton, crustacean, mollusk and fish are described. The problems involved in the interpretation of bioaccumulation data and the lack of understanding of the relationship between the 10-day laboratory test results and equilibrium concentrations in organisms are discussed. Conclusions from studies on tissue level accumulations of organisms in New York Sound indicate that organisms can apparently 'safely' accumulate tissue burdens that cause adverse effects in laboratory studies. (See also W87-08365) (Halterman-PTT)
W87-08383

OCEAN DUMPING OF DREDGED MATERIAL OFF THE LOUISIANA COAST,
Army Engineer District, New Orleans, LA.
R. J. Hardy.

IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 177-191, 10 tab.

Descriptors: *Ocean dumping, *Dredging, Water quality control, Water quality, Marine environment, Environmental effects, Ecosystems, Bioassay, Marine environment, Bioaccumulation.

Extensive bioassay and bioaccumulation testing of sediments from the Barataria Bay Waterway gulf approach channel were conducted to determine if their disposal would result in any chronic sublethal or acute toxicity effect on organisms living adjacent to the disposal site. The 100% suspended particulate phase or liquid phase did not approach the 96-hour LC50 for sheepshead minnow, grass shrimp or brine shrimp. Survival of clams, polychaete worms, or commercial shrimp was not reduced in the channel sediment during the solid phase. Clams and shrimp exposed to channel sediments during solid phase did not accumulate any statistically significant levels of constituents of concern. (See also W87-08365) (Halterman-PTT)
W87-08384

O & M DREDGING EXPERIENCE AS RELATED TO CHANNEL DEEPENING FOR COAL PORTS,
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 5E.
W87-08385

DENISON MANAGEMENT RELEASES,
Corps of Engineers, Huntington, WV. Huntington District.
R. E. Punnett, and J. C. Culbertson.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 200-207, 3 ref.

Descriptors: *Water resources development, *Water management, *Resources management, Water quality control, Water quality, Water use, Aquatic environment, Dams, Reservoirs, Reservoir operation.

Recent fish kills below two Oklahoma projects revealed the need for a management practice to prevent fish kills associated with low dissolved oxygen (DO) waters from bottom-release dams. A 10,000 cfs release through flood conduits for 30 minutes raised DO concentrations from near anoxia to near saturation almost immediately. A continuous release of 50 cfs through the flood conduits was sufficient to maintain the early morning DO concentration to near saturation values. A release of 135 cfs was sufficient to increase DO concentrations below Keystone Dam from 48 to 96% saturation in 4 hour. By pumping surface water downward to displace the hypolimnion at the conduit intake at Denison Dam, improvement in release water quality was possible. (See also W87-08365) (Halterman-PTT)
W87-08386

TURBINE VENTING AT CLARKS HILL DAM,
Army Engineer District, Savannah, GA.
For primary bibliographic entry see Field 8C.
W87-08389

WATER QUALITY MANAGEMENT AT HARRY S. TRUMAN DAM AND RESERVOIR,
Corps of Engineers, Kansas City, MO. Kansas City District.
W. M. Linder.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 245-271, 13 fig, 1 tab, 5 ref.

Descriptors: *Water quality control, *Water management, *Reservoirs, Multipurpose reservoirs, Reservoir operation, Environmental effects, Water resources development, Dams.

During the four and one-half years that have elapsed since the closure of the Harry S. Truman Dam, in west-central Missouri, several water quality problems have occurred. These have been corrected either by structural modifications or by adjustments in operation. The occurrence of downstream supersaturation was substantially reduced by the construction of deflectors or 'flip-lips' on the downstream face of the spillway and by limiting the amount of spillway discharges until completion of the construction of power facilites. Adaptation of the upstream haul road as a skimming weir should reduce the amount of deoxygenated water released during high reservoir levels and may totally prevent the occurrence during normal pool levels. Depression of downstream D.O. levels during periods of non-generation may be avoided by making small releases from the spillway during certain time of day. (See also W87-08365) (Halterman-PTT)
W87-08390

SUPERSATURATION OF NITROGEN GAS CAUSED BY ARTIFICAL AERATION IN RESERVOIRS,
Limnological Associates, Kaneohe, HI.
For primary bibliographic entry see Field 2H.
W87-08410

DESORPTION OF 2,3,7,8-TCDD FROM SOILS INTO WATER/METHANOL AND METHANOL LIQUID PHASES,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-08473

GROUND-WATER PROTECTION STRATEGY.
Environmental Protection Agency, Washington, DC. Office of Ground-Water Protection.
August 1984. 75 p, 1 tab, 20 ref, 6 append.

Descriptors: *Water quality control, *Groundwater management, *Groundwater, *Water quality management, *Groundwater pollution, *Water pollution, Environmental policy, Environmental protection, Water pollution control, Policy making.

The Environmental Protection Agency formed a task-force to: (1) identify areas of serious inconsistencies among programs and institutions at State, local, and Federal levels; (2) assess the need for greater program coordination within the EPA; and (3) help strengthen States' capabilities to protect the groundwater resources as they themselves define the need. The resulting document focuses on issues of groundwater quality including the nature and extent of groundwater contamination in the U.S., assigning responsibility for groundwater protection, and a summary of the proposed EPA strategy. The four major components of the EPA strategy are: (1) building up of institutions at the State level for a short-term; (2) assessing the problems that may exist from unaddressed sources of contamination with particular attention to leaking storage tanks, surface impoundments, and landfills; (3) issueing guidlines for EPA decisions affecting groundwater protection and cleanup; and (4) strengthening EPA's organization for groundwater management. (Wood-PTT)
W87-08495

EXAMPLE OF AUTOMATIC CONTROL OF WATER QUALITY (UN EXEMPLE DE CONTROLE AUTOMATIQUE DE LA QUALITE DES EAUX),
Service des Eaux, Services Industriels de Geneve (Switzerland).
P. Burkard, C. Cottet, and C. Etter.
Aqua AQUAAA, No. 1, p 11-21, 1987. 11 fig, 4 tab, 7 ref.

Descriptors: *Water quality, *Drinking water, *Artificial recharge, *Automation, Water treatment, Monitoring, Urbanization, Surface water, Chemical analysis, Chromium, Geneva.

The drinking water of Geneva and of the surrounding area (360, 000 ha) is supplied from treated surface water (Lake Leman - 1985: 53,000,000 cu m, 75% of the total supply) and from deep underground water (1985: 17,400,000 cu m, 25%). Since 1961, the groundwater level naturally fed by the river Arve's infiltration has been getting steadily lower because of increased pumping and lower natural supply. In order to maintain the pumping capacity and to guarantee the diversification of the water resources, the groundwater has been artificially fed since 1980 with 8-11,000,000 cu m/year. Water from the Arve is used for replenishment after being treated by pre-oxidation, flocculation, filtration and disinfection. To avoid quick silting of the filter beds as well as pollution of the underground water, several quality parameters of the raw and treated waters are continuously recorded. The replenishment is automatically shut off when the following values for the raw water are met: turbidity: 100 UT/F (corresponding to about 300 mg/l of suspended solids); hexavalent chromium: 0.020 mg/l Cr(VI); mercury: 0.0015 mg/l Hg; cadmium: 0.020 mg/l Cd; hydrocarbons: about 0.5 mg/l. At present the most frequent reasons for interrupting the treatment are, besides turbidity in high water periods, hydrocarbons and hexavalent chromium pollution. (Author's abstract)
W87-08518

AUTOMATIC MONITORING OF SURFACE WATER QUALITY: THE WARNING STATION OF LE MONT VALERIEN WATER TREATMENT PLANT,
Centre de Recherche Lyonnaise des Eaux - Degremont, Le Pecq (France).
For primary bibliographic entry see Field 5A.
W87-08519

IMPACT OF 'ORGANIC 'POLLUTANTS ON COASTAL WATERS, GULF OF TRIESTE,
Trieste Univ. (Italy). Ist. di Idraulica.
For primary bibliographic entry see Field 5C.
W87-08545

WASTEWATER DISPOSAL IN THE RIJEKA REGION,
Institute for Physical Planning and the Protection of the Environment, Istarska (Yugoslavia).
For primary bibliographic entry see Field 5E.
W87-08547

RECENT DEVELOPMENTS IN THE TREATMENT OF OILY EFFLUENTS,
Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. de Chimie et Genie de l'Environnement.
For primary bibliographic entry see Field 5D.
W87-08549

MEDITERRANEAN ACTION PLAN: A REGIONAL APPROACH TO POLLUTION CONTROL,
World Health Organization, Athens (Greece). Coordinating Unit for the Mediterranean Action Plan.
L. Jeftic, and L. J. Saliba.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 197-205, 1986. 12 ref.

Descriptors: *Water pollution control, *Water quality control, *Water pollution prevention, *Mediterranean Sea, *Mediterranean Action Plan, Water quality, Sewage Industrial wastes, Agricultural wastes, Pesticides, Fertilizers, Oil pollution, Legal aspects, Monitoring.

Increasing concern over the deterioration of the Mediterranean Sea as a result of increasing pollution by untreated sewage and industrial wastes, agricultural pesticides and fertilizers, and oil discharges, led to a series of meetings between 1970 and 1974, and finally to the UNEP-sponsored Mediterranean Action Plan, adopted by governments of the region in 1975 and ongoing since that time. The legal component of the Plan includes a framework Convention and four protocols; the environmental assessment component (the MED POL program) consists of national pollution monitoring programs, and research projects conducted by Mediterranean institutions; the environmental management component consists of the Blue Plan

(a perspective study combining socio-economic development with environmental preservation) and the Priority Actions Program (a series of sub-region sectoral projects in defined areas). The Plan has been financed by Mediterranean States since 1979, and is managed by UNEP with the cooperation of other competent UN Agencies. During the last ten years, activities undertaken have improved knowledge of the state of pollution of the Mediterranean Sea, and facilitated joint regional action in the form of preventative and control measures. (Author's abstract)
W87-08558

LEGAL AND ADMINISTRATIVE ASPECTS OF THE TREATMENT AND DISCHARGE OF INDUSTRIAL WASTEWATERS IN THE MEDITERRANEAN,
World Health Organization, Athens (Greece). Coordinating Unit for the Mediterranean Action Plan.
L. J. Saliba.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 207-219, 1986. 1 fig, 2 tab, 14 ref.

Descriptors: *Water pollution control, *Water quality control, *Wastewater disposal, *Industrial wastewater, *Legal aspects, *Mediterranean Sea, *Legislation, International law, Administrative regulations, Pollution load, Water pollution prevention.

Approximately 80-85% of the total Mediterranean pollution load originates from land-based sources. Industrial wastewater discharges form a significant proportion. National legal and administrative measures vary enormously within the region, and coverage and coordination need improvement, as do waste management and disposal practices. The only legal instrument providing overall regional coverage is the 1980 Protocol for the Protection of the Mediterranean Sea against pollution from Land-based Sources, which only provides the framework for programs and measures to be progressively developed. In reviewing the situation regarding the treatment and discharge of industrial wastewaters in the Mediterranean, a recent WHO Workshop emphasized the integrated nature of the pollution problem, and stressed that a regional code of practice for industrial waste discharge should form an integral part of an overall pollution control framework. National programs should be undertaken progressively in ascending order of complexity to ensure cost-effectiveness and capability of enforcement. Treatment and re-use of industrial wastewaters could provide a new water resource. Interim effluent standards should be established until such time as the capability is developed to define local environmental quality criteria, on which firm effluent standards could then be based. The progressive implementation of such measures would help in finally resolving the problem of industrial pollution in the region. (Author's abstract)
W87-08559

OBJECTIVES AND ACHIEVEMENTS OF THE THREE CONFERENCES ON THE PROTECTION OF THE ADRIATIC SEA,
A. Kalpic.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 221-228, 1986. 3 ref.

Descriptors: *Water quality control, *Water pollution control, *Water pollution prevention, *Adriatic Sea, *Conferences, Environmental control, Marine environment, Environmental policy, Environmental protection, Environmental quality.

Three of the conferences held so far on the protection of the Adriatic Sea (Opatija 1974, Hvar 1979 and Budva 1984) each in their own way gave their scientific, professional and social contribution to determining the existing conditions and future activities that should be undertaken in order to protect the human environment in the area of the Adriatic Sea. The objectives and achievements of each of these conferences were presented using actual documents. The existing problems, programs and planned development were taken into account. Progress in organizing the IV. Conference (1989) was reported as one example of the work done on preventing pollution and undertaking efficient measures that would lead to a greater success in protecting the human environment through development in the area of the Adriatic Sea. (Author's abstract)
W87-08560

CONTROL OF POLLUTION FROM RIVER DISCHARGES IN THE MEDITERRANEAN,
Michigan Univ., Ann Arbor. School of Public Health.
K. H. Mancy.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 229-242, 1986. 8 fig, 5 tab, 32 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Water quality control, *Water pollution control, *Mediterranean Sea, *River flow, Rivers, Water quality, Rhone River, Po River, Ebro River, Nile River, River basins, Management planning.

The pollution burden of river discharges in the Mediterranean far exceeds all other sources, e.g. land based sources. The main contributors are the Rhone, Po and Ebro. Contributions from the River Nile are expected to be much less than those from rivers in the European continent. Recent Nile management schemes and irrigation projects in Egypt are posing direct impacts on the Mediterranean. This includes the erosion of the Nile Delta and offshore pollution due to wastewater discharges. In view of the prevailing circulation patterns in the Mediterranean, these impacts are dominant in the South Levantin region. Current practices of river management do not necessarily include the protection of marine resources. Similarly, sea protection programs do not include pollution from sources in the river basin. Marine management programs are largely concerned with pollution loads at the points of river discharge. In the case of a landlocked sea, such as the Mediterranean, it is particularly important to integrate river basin management schemes in the sea protection program. Under a suitable management plan, it could be possible to determine the main sources of sea pollution within the river basin. This should serve as the basis for the implementation of control measures, since the problem is not exclusively within the river basin. (Author's abstract)
W87-08561

PLANNING THE DISPOSAL OF WASTE WATERS FOR SMALL TOURIST RESORTS IN DALMATIA,
Split Univ. (Yugoslavia). Faculty of Civil Engineering Sciences.
For primary bibliographic entry see Field 5E.
W87-08562

RELEVANCE OF CONTAMINATED SEDIMENT STUDIES IN THE GREAT LAKES TO POLLUTION ASSESSMENT AND CONTROL IN THE MEDITERRANEAN SEA,
Canada Centre for Inland Waters, Burlington (Ontario).
R. J. Allan.
Water Science and Technology WSTED4, Vol. 18, No. 9, p 317-325, 1986. 6 fig, 11 ref.

Descriptors: *Water quality control, *Water pollution, *Sedimentology, *Sediments, *Comparison studies, *Great Lakes, *Mediterranean Sea, Pollutants, Water pollution sources, Path of pollutants, Sampling, Bottom sampling, Lake sediments, Bottom sediments, Water pollution control.

In the Laurentian Great Lakes of North America, pollution status, trends and source identification have benefitted greatly from systematic collection and analyses of lake bottom sediments. Similar systematic surveys, using strict sampling and analytical protocols, might provide the same type of valuable information for the Mediterranean, especially for nearshore areas, off the mouth of major rivers, or for entire regional areas such as the Adriatic or Aegean. (Author's abstract)
W87-08569

SCREENING METHOD FOR CONTAMINANT PLUME CONTROL,
Illinois State Water Survey, Champaign. Ground-Water Section.
For primary bibliographic entry see Field 5B.
W87-08592

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

URBAN WATER INFRASTRUCTURE: PLANNING, MANAGEMENT, AND OPERATIONS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 5D.
W87-07703

RESEARCH DESIGN AND WORK PLAN FOR CULTURAL RESOURCE STUDIES IN THE DISTRIBUTION DIVISION OF THE CENTRAL ARIZONA PROJECT,
Northland Research, Inc., Flagstaff, AZ.
For primary bibliographic entry see Field 6G.
W87-07723

IMPROVED MANAGEMENT SYSTEMS A MUST,
Camp, Dresser and McKee, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W87-07827

ICA - INFORMATION SYSTEMS - WHERE NEXT,
Bristol Waterworks Co. (England).
For primary bibliographic entry see Field 7A.
W87-08087

RESERVOIR OPERATION (LA GESTION DES BARRAGES RESERVOIRS),
Electricite de France, Chatou.
For primary bibliographic entry see Field 4A.
W87-08277

WATER CONTROL OPERATING CONSTRAINTS,
C. E. Abraham.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 123-127.

Descriptors: *Water management, *Reservoir management, Resources management, Resources development, Lakes, Reservoirs, Multipurpose reservoirs, Legal aspects.

The constraints that water control managers must work within are covered. Four categories are discussed: structural, physical, environmental, and legal. In order to insure that the water control manager achieves the authorized net payoff, he must try to identify the interaction of impacts from actions taken, reveal and display those impacts, identify tradeoffs involved, formulate institutional engineering and economic alternatives, and consult with appropriate representatives of the public before adopting a plan of action. The authority and responsibility to make final decisions rests with the water control manager. (See also W87-08365) (Halterman-PTT)
W87-08379

ANALYZING SALINITY RESPONSE IN SAN FRANCISCO BAY,
Corps of Engineers, San Francisco, CA. San Francisco District.
For primary bibliographic entry see Field 5B.
W87-08388

WATER QUALITY ASSESSMENT: A SCREENING PROCEDURE FOR TOXIC AND CONVENTIONAL POLLUTANTS; PART 2,

Tetra Tech, Inc., Lafayette, CA.
For primary bibliographic entry see Field 5B.
W87-08409

INTERACTIVE COMPUTER-AIDED WATER RESOURCES AND ENVIRONMENTAL PLANNING USING COLOR RASTER GRAPHICS: PROGRAMMER'S GUIDE,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
P. N. French, M. R. Taylor, and D. P. Loucks.
Available from the National Technical Information Service, Springfield, Va 22161, as PB83-170084. Price codes: A12 in paper copy; and A01 in microfiche. NSF/CEE-82084, December 1982. 254 p, 6 append.

Descriptors: *Planning, *Computer programs, *Data processing, Graphical analysis.

An overview of the Computer-Aided Planning (CAP) program is provided. The following topics are discussed: hardware and software requirements; compilation, linkage and execution; common block variable definition and initialization; screen display coordinates; aspect ratio; pen and tablet operations; menu area description; color description; color map generation; and master file display. The appendixes include: an alphabetized list of all FORTRAN subprogram names contained in the CAP software and the files in which they reside; a listing, by file, of all CAP program names; the header block description of each CAP subprogram; a description of all Grinnell and RLE subprograms used; a list of all CAP subprograms which access Grinnell and RLE subprograms; and a list of the command procedures used to compile necessary files, create object libraries, and link and execute the program. (Author's abstract)
W87-08417

PROCEEDINGS OF THE NATIONAL WATER CONSERVATION CONFERENCE ON PUBLICLY SUPPLIED POTABLE WATER.
Dynamac Corp., Rockville, MD.
For primary bibliographic entry see Field 5F.
W87-08420

DEVELOPING AND TESTING A WATER CONSERVATION HANDBOOK,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 3D.
W87-08427

IMPACT INTERACTION POTENTIAL: A BASIN-WIDE ALGORITHM FOR ASSESSING CUMULATIVE IMPACTS FROM HYDROPOWER PROJECTS,
Envirosphere Co., Bellevue, WA.
For primary bibliographic entry see Field 6G.
W87-08537

6B. Evaluation Process

SOIL AND WATER RESOURCES: RESEARCH PRIORITIES FOR THE NATION.
Soil Science Society of America, Inc., Madison, WI.
Soil Science Society of America, Inc., Madison, Wisconsin, 1981. Edited by William E. Larson, Leo M. Walsh, B. A. Stewart, and Don H. Boelter. 229 p.

Descriptors: *Water resources, *Soil resources, *Research priorities, *Water conservation, *Water policy, *Water management, *Soil conservation, Water demand, Water use, Decision making, Resources management, Public policy, Land use, Policy making, Water law, Project planning, Soil erosion, Land reclamation, Political aspects.

A National Workshop was held February 23-27, 1981 in Madison, Wisconsin to identify national research priorities regarding the uses, management, and conservation of soil and water resources. Nine working panels covered topics of water as a basic resource, land resource bases and inventory, policy alternatives and consequences of conservation technology on agricultural land, and the conservation needs and technology of humid regions, semiarid and arid regions, forest land, rangeland, urban and recreational lands, and drastically disturbed lands. Each of the nine panel reports was carefully considered in developing the six most important research priorities for the nation. These include: sustaining soil productivity, developing conservation technology, managing water in stressed environments, protecting water quality, improving and implementing conservation policy, and assessing soil and water resources. In addition, five featured speakers addressed the following topics: land and water use in agriculture, the Resource Conservation Act and future soil and water research priorities, future research priorities for soil and water resources, public policy directions for soil and water research, and politics and pressure groups at the federal level. (See also W87-07681 thru W87-07689) (Geiger-PTT)
W87-07680

CASE HISTORY OF A FLOODING DISASTER AT A WASTEWATER TREATMENT PLANT: MCKEESPORT, PA,
McKeesport Municipal Authority Wastewater Treatment Plant, PA.
For primary bibliographic entry see Field 2E.
W87-07867

WHO IS RESPONSIBLE FOR THIS MESS - PUBLIC PERCEPTIONS OF THE WASTE MANAGEMENT ISSUE,
Environmental Action Foundation, Washington, DC.
For primary bibliographic entry see Field 5E.
W87-08184

PATHOGEN REDUCTION STUDIES IN EPA'S SLUDGE MANAGEMENT PROGRAM,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
For primary bibliographic entry see Field 5D.
W87-08209

WATER CONTROL OPERATING CONSTRAINTS,
For primary bibliographic entry see Field 6A.
W87-08379

FLOW REDUCTION: METHODS, ANALYSIS PROCEDURES, EXAMPLES,
INTASA, Inc., Menlo Park, CA.
For primary bibliographic entry see Field 5F.
W87-08428

STATE WATER CONSERVATION PLANNING GUIDE,
Water Resources Council, Washington, DC. State Programs Div.
D. L. Fisher, and J. A. Yost.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 91-102, 1 tab.

Descriptors: *Water conservation, *Management planning, *Water policy, *State jurisdiction, Handbooks, Standards, Economic aspects.

The U.S. Water Resources Council, under the authority of Title III of the Water Resources Planning Act of 1965, provides grants to State for the development of comprehensive water and related land resources plans. Through the water policy initiatives of President Carter in 1978, agencies were directed to emphasize the integration of water conservation in the implementation of water resource management programs. Acting upon these initiatives and the directives of the President, the Water Resources Council emphasized the integration of water conservation in State programs. To assist States in this endeavor, the Council developed the State Water Conservation Planning Guide. The planning guide is to be used primarily by State water planners in establishing and implementing a water conservation program. The guide details many of the necessary actions to implement an effective water conservation program. A prime objective of this guide is to bridge the gap that exists in many States between State and local water planning and implementation efforts. It is imperative that the participation and support of local utilities, municipalities, and other water purveyors be solicited during plan development and extended into implementation. The philosophy and objective of the planning guide, the proposed implementation guide, and the Water Resources Council grant program were always to extend Federal assistance, both technical and financial, down to the States, and through the States to local water purveyors. To accomplish more efficient water use, Federal efforts must be carried down to the local level. (See also W87-08420) (Author's abstract)
W87-08429

PLANNING FOR THE FUTURE,
Seattle Dept. of Water, WA.
P. C. Knox.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 147-150, 9 ref.

Descriptors: *Water conservation, *Planning, *Seattle, *Washington, Rainfall, Cost analysis, Evaluation.

There is a long-standing base of environmental consciousness among the people of the Pacific Northwest. The conservation ethic is an important part of policies and actions affecting the region's organizations strongly recommended water conservation as an alternative to development of new resources. The low rainfall of 1976-77 was the incentive to the Seattle Water Department to consider the conservation alternative. The Department examined the feasibility of the subject during the three ensuing normal years and, in 1980, the City adopted a Conservation Program. Without an impending disaster, the Program could assume a course based upon human value and rationality associated with future sources of supply. A cost/benefit analysis was conducted during the initial study for the Program based on an 8% reduction in total demand to be reached over a 10-year period. The findings supported the adoption of the Program. The need to construct another source of supply will be delayed by 6 - 7 years if the Program goal is reached. At the core of the Program are six voluntary cooperation projects and three public use management projects. Water customers were targeted and specific water use habit changes were identified to accomplish demand reductions through the projects. Program evaluation methods are being closely monitored by the City Council, which expects timely accomplishment of the projected reductions. Currently, the Office is involved in assessing evaluation in the light of staffing, methods and computer capabilities. (See also W87-08420) (Author's abstract)
W87-08434

ENHANCED WATER EDUCATION VERSUS STATUS QUO ET AL.,
Water and Man, Inc., Salt Lake City, UT.
J. A. Barnett.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 173-177, 2 append.

Descriptors: *Education, *Water resources development, Information exchange.

Water resource authorities, appointed by the governors of the twelve western states, determined six years ago that there was a significant need for better water education. These officials, members of the Western States Water Council, felt it was important for the public to be well informed on water resource issues as the nation moves ahead and faces many difficult water resource decisions. They de-

termined that the Western States Water Council was not the appropriate vehicle for the preparation of these water education programs, and that the need for water education was not limited to the western United States. The Council instructed that a non-profit water education corporation be formed to pursue these most worthwhile educational efforts. Water and Man, Inc., is the new nonprofit corporation fostered by the Council, and has been growing from a very humble beginning six years ago, through various stages of support, solicitation, fund raising, and the creation of water education materials. The Trustees of Water and Man have determined that their first effort would be to prepare and disseminate quality water education materials to be used in the public schools of the nation in grades K-12. Initial materials have been prepared and they are currently being disseminated to participating states. (See also W87-08420) (Author's abstract)
W87-08438

INFORMATION AND CONSUMER ADOPTION OF WATER CONSERVATION MEASURES,
Southern Illinois Univ. at Carbondale. Dept. of Geography.
For primary bibliographic entry see Field 3D.
W87-08439

PROCEDURES MANUAL FOR EVALUATING WATER CONSERVATION PLANNING,
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
J. E. Crews, and K. E. Schilling.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 197-206, 4 fig.

Descriptors: *Water conservation, *Guides, *Management planning, Evaluation, Water resources development, Groundwater supply, Legislation, Water transfer, Economic aspects.

In the past few years, the role of water conservation in the management and planning of water resources has become increasingly important. A number of factors account for this emphasis: (1) new reservoir sites have become increasingly scarce; (2) concern for environmental quality has grown; (3) groundwater resources are increasingly inadequate to meet the demands of urban areas; (4) political, economic, and institutional problems of interbasin transfers have proliferated, making it nearly impossible to plan for transfer of water from one basin to another; (5) the costs of water resource development have risen enormously in the last decade as a result of the increase in the price of energy, the increase in the cost of money, and the rise in water quality standards as manifested in the passage of Federal legislation such as the Federal Water Pollution Control Act Amendments (1972), the Safe Drinking Water Act of 1974, and the Clean Water Act of 1977; and (6) the demand for urban water has continued to increase. In combination, these factors have created a situation which directs attention to the possibilities of water conservation. (See also W87-08420) (Lantz-PTT)
W87-08441

BEFORE THE WELL RUNS DRY: A HANDBOOK FOR DESIGNING A LOCAL WATER CONSERVATION PLAN.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 3D.
W87-08443

MUNICIPAL WATER CONSERVATION -- A WATER PROJECT THAT PAYS FOR ITSELF,
INTASA, Inc., Menlo Park, CA.
For primary bibliographic entry see Field 3D.
W87-08447

DEVICES AND TECHNOLOGIES FOR WATER CONSERVATION - STATE OF THE ART: STANDARDS FOR INDUSTRY,
Waltec, Inc., Wallaceburg (Ontario).
For primary bibliographic entry see Field 3D.
W87-08448

MANAGEMENT INFORMATION SYSTEMS FOR WATER RESOURCES,
North Carolina State Univ. at Raleigh.
For primary bibliographic entry see Field 10D.
W87-08455

KEYNOTE ADDRESS,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 3D.
W87-08456

COMPARISON BETWEEN WATER CONSERVATION PRACTICES IN THE UNITED KINGDOM AND THE UNITED STATES,
Thames Water Authority, Reading (England).
For primary bibliographic entry see Field 3D.
W87-08457

FEDERAL WATER RESOURCE AGENCY PLANNING REQUIREMENTS AND IMPLICATIONS FOR WATER CONSERVATION,
Water Resources Council, Washington, DC.
G. D. Seinwill.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 373-378.

Descriptors: *Water conservation, *Water resources development, *Water management, Public policy, Water policy, Legal aspects, Planning, Economic aspects, Environmental aspects.

The 1978 executive water policy reform message was not a radical departure from earlier policy directives. However, its specificity about the role of conservation in water planning and management, its applicability to wider ranges of water activities, and its urgency for immediate response have differed from previous water policy statements. Federal agencies dealing with water-related programs or projects were mobilized to initiate prompt action to address water program proposed measures. The 'Principles and Standards' were revised by the Water Resources Council to integrate water conservation into project and program planning and to widen the range of options considered to include alternatives that Federal, State, or local entities might implement. The Water Resources Council's 'State Conservation Planning Guide' (October 1980) reflects the increased emphasis on State responsibility to implement conservation measures. State grant applications to support water conservation actions reflect a wide range of conservation measures that are planned or currently being implemented. The Federal Government has created incentives for and obviated disincentives for water conservation. Instead of a monolithic pattern of resource management and planning, States can work with the Federal Government to tailor measures to meet local needs and economies. During the past 80 years, the national concept of water conservation has shifted focus to reflect current economic conditions and contemporary attitudes toward environmental resources. Distinctions in political philosophies have often blurred when the Government takes action on water conservation. Economic conditions, national emergencies, or natural disasters such as droughts frequently play a greater role in public evaluation of resources than does any specific partyline attitude. The definition of water conservation and the role it plays in water resource planning generally changes with the changing times, particularly when there is a drastic change in the economy. (See also W87-08420) (Author's abstract)
W87-08458

APPRAISAL OF 1978 CONFERENCE CASE HISTORY: DO THE BENEFITS ENDURE,
Washington Suburban Sanitary Commission, Hyattsville, MD.
J. M. Brusnighan.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 427-432.

Descriptors: *Case studies, *Water conservation, *Water resources development, *Maryland, *Montgomery County, *Prince George's County, Evaluation, Water supply, Water management, Planning.

The Washington Suburban Sanitary Commission (WSSC) is an independent water and sewer authority set up by the State of Maryland, providing service to the two Maryland Counties, Montgomery and Prince George's, immediately adjacent to the Nation's Capital. A population of about 1.2 million is served, which represents 240,000 accounts. The WSSC is currently supplying an average of about 130 million gallons of water a day, and operates and/or shares seven sewage treatment plants. In the early 1970's, there were three reasons why a water conservation program was essential for the WSSC: a pending water/sewer shortage, a developing 'conservation ethic,' and a planning stalemate over future water demands and resultant sewer capacities. (See also W87-08420) (Lantz-PTT)
W87-08464

RESULTS OF A PEAK MANAGEMENT PLAN FOR TUCSON, ARIZONA,
Tucson, AZ.
G. E. Cronk.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 453-464, 4 fig, 4 tab, 1 ref.

Descriptors: *Management planning, *Tucson, *Arizona, *Water conservation, Utilities, Rates, Cost analysis, Landscaping, Domestic water, Water use, Vegetation, Grasses.

Prior to the summer of 1974, the prevailing water service philosophy of the Tucson Water Utility had been to anticipate, and meet, the unmanaged peak demand requirements of the system by increased capital expenditures for expansion of the water system. The peak demand period of the summer of 1974, however, proved to be one of the driest and hottest periods on record in Tucson. The City well system proved to be incapable of consistently meeting the prolonged peak periods. This resulted in localized disruptions in service and chronic low pressures throughout the system. The experiences of that summer convinced the staff of Tucson Water and their engineering consultants of the need to evaluate and reassess the original service philosophy regarding meeting future unmanaged peak demand requirements. In the summer of 1976, the City Council adopted a new water rate structure designed to reduce peak period use through an inverted rate structure. They also adopted a controversial 'System Development Charge,' intended to recover the capital costs created by new connecters to the system. The new rates and charges proved to be very controversial and unacceptable to a large segment of the Utility's customers. These problems as well as other factors involved with community growth led to the recall of four members of the Council and repeal of controversial lift and system development charges. Collectively, individual user classes have modified their usage patterns principally in their outdoor watering habits. Substantial numbers of multifamily living units and single family residences have removed lawns and plantings and replaced them with low water use desert landscaping. These are permanent changes in lifestyle and indicate a permanent reduction in peak usage and in daily per capita use. Living units with these low maintenance, low water consumption features have become prime selling points to the local real estate market which further encourages individual users to cooperate with the program. The City of Tucson has done much to promote the program by serving as an example. Street medians, formerly planted in grasses and other high water use plantings, have been replaced with attractive and low

water-consuming desert vegetation. Also, the local building industry has made greater use of low-flow fixtures in many new developments as well as making these fixtures available for voluntary retrofitting at the individual homeowners option. (See also W87-08420) (Lantz-PTT)
W87-08468

BUDGETING OF WATER DISTRIBUTION IMPROVEMENT PROJECTS,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6C.
W87-08595

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

SAVING WATER IN A DESERT CITY,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 3D.
W87-07697

NEW POWER ON THE OHIO RIVER,
A. Slakter.
Engineering News - Record ENREAU, Vol. 218, No. 4, p 92-93, January 1987.

Descriptors: *Hydroelectric plants, *Hydroelectric power, *Locks, *Financing, Ohio River, New Martinsville, Ohio, Head flume.

Bolstered by a novel financial agreement, a 34-Mw hydroelectric powerplant is under construction adjacent to an existing lock-and-dam on the Ohio River. Although the City of New Martinsville, West Virginia, had a Federal Energy Regulatory Commission license to build the powerplant, the project had stalled because the city lacked money to develop it. A private power developer assumed ownership of the plant and obtained outside financing. The City retains the FERC license. The developer will operate the powerplant and pay the city royalties on power sales. A 47 year fixed cost contract has been signed for a power company to purchase the generated power. Working with only a 21 foot head of water, two 17-Mw submerged turbine-generator systems, with a maximum capacity of 14,000 cfs, will be used. (McFarlane-PTT)
W87-07832

RECENT SEWAGE FINANCING IN PENNSYLVANIA,
Collings, Legg, Mason, Inc., Philadelphia, PA.
H. Chapman.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 20, No. 2, p 33, March-April 1987.

Descriptors: *Cost allocation, *Economic aspects, *Cost repayment, *Costs, *Financing, *Sewer systems, Sewage rate, Wastewater, Pennsylvania, Wastewater disposal, Bond issues.

Because of the lack of grant money to help the funding of sewer, water and other municipal projects, innovative procedures have been used by the Municipal Authorities of several counties in Pennsylvania. The common problem of requiring sewage collection and treatment for existing families, but having insufficient families to support the cost of building the system, has been addressed by evolving a plan using future growth as a substitute for grant money. Developers made up front capital contributions and pledged an annual fee for a limited time or until the purchaser of the house assumed the annual sewer usage charge. Existing homeowners were also assessed. The Township also assisted by providing a guarantee for the Bond Issue and by pledging a sum of securities and money equal to the debt service reserve fund. Various fees were also levied by other townships to raise additional money for their sewer projects. (Wood-PTT)
W87-07871

EVALUATING AND SELECTING FINE BUBBLE DIFFUSERS,
Houck (D.H.) Associates, Inc., Silver Spring, MD.
For primary bibliographic entry see Field 5D.
W87-07927

ECONOMIC VALUE OF INSTREAM FLOW: METHODOLOGY AND BENEFIT ESTIMATES FOR OPTIMUM FLOWS,
California Univ., Davis. Div. of Environmental Studies.
For primary bibliographic entry see Field 6D.
W87-08085

GROUNDWATER RECHARGE OPERATIONS AT WATER FACTORY 21, ORANGE COUNTY, CALIFORNIA,
Orange County Water District, Fountain Valley, CA.
D. G. Argo, and N. M. Cline.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 359-395, 8 fig, 28 tab, 14 ref.

Descriptors: *Artificial recharge, *Water reuse, *Groundwater recharge, *California, *Cost analysis, Operating costs, Water supply development, Injection, Groundwater management.

The capital and actual operating costs for fiscal year 1980-1981 (FY) for each unit process within the AWT plant at WF21 are summarized. AWT capital cost is $639/million gallons and AWT operating and maintenance cost is $992/million gallons. RO capital cost is $241/million gallons, and O and M cost is $7980/million gallons. The capital cost of the deep well water blending system is $62/million gallons and the operating cost is $169/million gallons. The cost of injecting the waters produced by the AWT, RO, and deep well facilities is $64 million gallons capital and $34/million gallons O and M. When AWT, RO, and deep well costs are combined and injection costs added, the cost of the blended water injected is $593/million gallons capital and $1,031/million gallons O and M, for a total cost of $1,624/million gallons. The actual costs incurred during FY81 were projected to reflect operation at design flow. The following basic assumptions were made to develop these projections: (1) The AWT process treated 15 mgd at a 90% plant factor (PF); (2) The RO plant received 6 mgd of AWT water for demineralization and produced 5 mgd with a 90% PF; (3) Therefore, the AWT plant produced 9 mgd at 90% PF; (4) Six mgd deep well water was extracted to blend with 5 RO and 9 AWT to give a total injection of 20 mgd; (5) All energy and chemical requirements were projected on the basis of actual quantities required to treat expanded flows; and (6) Labor and maintenance costs were based on actual expense incurred during FY81. Studies made by the Orange County Water District have indicated that when wastewater reclamation projects are evaluated on an energy-cost basis, they show even greater potential savings than when compared strictly on a dollar and cents basis. Current estimates for delivering northern California water through the State Water Project to the southern California area indicate an energy cost of 10,000 kWh/million gallons. The energy cost of furnishing Colorado River water to southern California is 6,400 kWh/million gallons. (See also W87-08137) (Lantz-PTT)
W87-08149

ECONOMIC ASPECTS OF GROUNDWATER RECHARGE,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 4B.
W87-08162

COST-EFFECTIVE RESIDENTIAL WATER CONSERVATION DECISIONS,
National Bureau of Standards, Washington, DC. National Engineering Lab.
For primary bibliographic entry see Field 3D.
W87-08444

BUDGETING OF WATER DISTRIBUTION IMPROVEMENT PROJECTS,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
F. A. Karaa, D. H. Marks, and R. Clark.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 378-391, May 1987. 6 tab, 37 ref. EPA Cooperative agreement CR810558-01-0.

Descriptors: *Planning, *Model studies, *Budgeting, *Financing, *Water distribution, *Rehabilitation, Water mains, Management, Maintenance.

A linear programming formulation of the resource allocation problem applied to water distribution system rehabilitation and reconstruction is presented. The decision variables are fractions of large bundles of water mains to be rehabilitated or replaced throughout the planning horizon. The model can be used by municipal planners for scheduling capital expenditures related to water distribution system improvement and maintenance and is therefore a major component of a maintenance management system. (Author's abstract)
W87-08595

6D. Water Demand

SOIL AND WATER RESOURCES: RESEARCH PRIORITIES FOR THE NATION.
Soil Science Society of America, Inc., Madison, WI.
For primary bibliographic entry see Field 6B.
W87-07680

WATER: A BASIC RESOURCE,
Agricultural Research Service, Riverside, CA. Salinity Lab.
J. Van Schilfgaarde, G. J. Kriz, N. Bouwes, J. Bucheim, and J. M. Davidson.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc., Madison, Wisconsin, 1981. p 1-19, 10 ref.

Descriptors: *Water resources management, *Water management, *Research priorities, *Water quality, *Water demand, *Water supply, *Water pollution prevention, Water use efficieny, Acid rain, Pesticides, Sediments, Salinity, Arid lands, Semiarid lands, Humid areas, Nutrients, Policy making, Irrigation, Water allocation.

Agriculture, mineral extraction and processing, energy generation, manufacturing, commerce, navigation, recreation, and domestic activities are all dependent to some extent on water. In the United States, average daily withdrawals of fresh water are about 54% of dependable supplies. Seventy-five percent of the agricultural production depends on precipitation. In humid regions, there is a need for adequate drainage of fields and a total water management system that modulates the soil water regime to best fit the crop. Erosion and sedimentaion must also be controlled to ensure good crop yields. Similar problems exist in semiarid regions along with the need for soil water conservation. In arid regions water conservation through effective irrigation management is essential. Brackish water can be used to grow halophytes, and the biomass obtained in this fashion can be used to harvest energy. Sediment, the product of erosion, is the greatest polluter of water. Other pollutants are salt, acid rain, nutrients, pesticides, and mine wastes. Research policy and priorities vary in the East, Midwest, Southeast, and West, and depend on the end use of water. Institutional changes are needed to provide the incentives for individuals to use technologies that conserve water resources for the common good. More research is needed on water conservation, water availability, water quality for beneficial use, institutional constraints and facilitators, and assessment methods. (See also W87-07680) (Geiger-PTT)
W87-07681

SCARCE WATER AND INSTITUTIONAL CHANGE.
Resources for the Future, Inc., Washington, DC.
Resources for the Future, Inc., Washington, DC, 1986. 207 p.

Descriptors: *Water demand, *Water use, *Water costs, *Water scarcity, *Water shortage, Water law, Water use efficiency, Case studies, Water resources development, Water requirements, Irrigation requirements, Water rights, Water supply, Institutions, Water policy, Hydroelectric power.

In the early 1980's, reports on water shortages coinciding with major droughts caused concern about the nation's future water supplies. This book uses case studies to shed light on such problems as groundwater mining, contamination of supplies, deteriorating water supply facilities, and rising costs in various parts of the country and suggests ways of resolving them. The first four studies focus on areas experiencing problems with projected water needs or with allocating scarce supplies among competing uses. The studies of the Pacific Northwest, Kern County in California, the coastal area of southern California, and southeastern Virginia examine the water situations in these locations and assess alternative means of meeting their long-term water needs. The final study, which examines the development and operation of the Colorado-Big Thompson Project in northeastern Colorado, is a detailed look at an innovative institutional arrangement that has facilitated the reallocation of water in response to changing conditions. Topics addressed in the case studies that have broad relevance for water supply management include: the role of institutional factors, especially water laws and administrative arrangements, in creating and solving a region's water problems; the factors that promote or inhibit flexibility for responding to changing water supply and demand; the potential role of markets and prices for allocating scarce water supplies and creating incentives to conserve water; and institutions and conditions that encourage water marketing. (See also W87-07691 thru W87-07696) (Geiger-PTT)
W87-07690

OVERVIEW,
Resources for the Future, Inc., Washington, DC.
K. D. Frederick.
IN: Scarce Water and Institutional Change, Resources for the Future, Inc., Washington, DC, 1986. p 1-24, 5 ref.

Descriptors: *Water demand, *Water use, *Water costs, *Water scarcity, *Water shortage, Water law, Water use efficiency, Case studies, Water resources development, Water requirements, Irrigation requirements, Water rights, Water supply, Institutions, Water policy, Hydroelectric power.

In the early 1980's, concern over the nation's water supply brought on by drought conditions received wide coverage. As more normal patterns of precipitation returned, the crisis atmosphere receded and little has been done to prevent future shortages of water. Traditional structural approaches (dams, reservoirs, wells) to preventing and solving water problems approximated an efficient strategy when the direct costs of providing reliable supplies were low and streamflows were sufficient to meet all demands. Nontraditional means of increasing water supplies such as desalination, transporting icebergs, and weather modification, offer no panacea. This book presents five case studies of areas experiencing water shortage problems and examines ways in which these problems were resolved. Although the studies are written by economists, economic efficiency is not the sole criterion for managing scarce water resources; institutional barriers and equity implications of proposed water management alternatives receive equal consideration. For Kern County, Southern California, and Virginia Beach, the focus of the water management problems is the quantity of water available for offstream use; for the Pacific Northwest, the focus is the allocation of water between irrigation and hydroelectric power; and for Northeast Colorado, the focus is the institutional mechanism for transferring water among users. This overview also addresses the emerging issues of water uses, water law, water markets, and Indian and federal water rights. (See also W87-07690) (Geiger-PTT)
W87-07691

COMPETITION BETWEEN IRRIGATION AND HYDROPOWER IN THE PACIFIC NORTHWEST,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
W. R. Butcher, P. R. Wandschneider, and N. K. Whittlesey.
IN: Scarce Water and Institutional Change, Resources for the Future, Inc., Washington, DC, 1986. p 25-66, 2 fig, 3 tab, 28 ref.

Descriptors: *Competing use, *Water use, *Water demand, *Irrigation, *Hydroelectric power, Water law, Water costs, Water allocation, Water management, Fisheries, Water supply, Water quality, Navigation, Value, Water rights, Case studies, Water transfer, Institutions, Water policy.

The economics of the hydropower-irrigation tradeoff in the Pacific Northwest are examined and the institutions that guide allocation of water are reviewed in two case studies involving the Columbia River Basin: the Swan Falls case in Idaho, and the Columbia Basin Irrigation Project. The Columbia River and its tributary, the Snake River, are used for fisheries, irrigation, navigation, and hydroelectric power production. In the Swan Falls case, the Idaho Power Company has sued hundreds of irrigators and the State Department of Water Resources, charging a taking of water that rightfully belongs in the Snake River where it can be used to generate electricity. The Idaho Supreme Court decided that additional withdrawals for irrigation could be made only with the permission of, and payment of compensation to the Idaho Power Company. Responses to the Swan Falls decision included three alternatives: subordination of hydropower water rights, condemnation of hydropower rights, and acceptance of the court decision. In the second case study, the growing debate about how a proposed 500,000-acre expansion of the U. S. Bureau of Reclamation's Columbia Basin Irrigation Project will affect the cost of electricity is examined. The Columbia Basin Irrigation Project case illustrates a basic conflict between state and federal control of water allocation. If greater efficiency is to be gained in water use in the Northwest, the following four areas are in need of institutional reform: eliminating subordination of hydropower rights to potential future irrigation development, correcting interstate externalities, reconciling state and federal water law, and facilitating interstate transferability of water rights. (See also W87-07690) (Geiger-PTT)
W87-07692

WATER SCARCITY AND GAINS FROM TRADE IN KERN COUNTY, CALIFORNIA,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. J. Vaux.
IN: Scarce Water and Institutional Change, Resources for the Future, Inc., Washington, DC, 1986. p 67-101, 4 fig, 7 tab, 24 ref.

Descriptors: *Water costs, *Water demand, *Water rights, *Case studies, *Water scarcity, Water shortage, Water supply, Water rights, Institutions, Water policy, Irrigation water, Water transfer, Water use, Water requirements, Irrigation requirements, Water law, Cost allocation.

Kern County, the third-largest county in California, is the second largest in agricultural production in the state. Water scarcity problems in Kern county are attributed to inadequate supplies of cheap irrigation; the state is unable to deliver the full amount of its contractual water obligations due to groundwater overdraft. Three ways of resolving the problem are suggested. First, it is possible that neither new supplies nor the institutional changes needed to permit water marketing will be realized. Under this scenario, groundwater overdraft is likely to continue and even increase if water now surplus to the needs of the Los Angeles basin becomes unavailable. Economic losses associated with the elimination of groundwater overdraft would likely grow from the current estimated value of $24 million annually, and some economic dislocations would result. A second resolution involves the construction and operation of additional water supply facilities by the state, a solution that appears too costly. A final resolution involves making the legal and institutional changes necessary to create water markets. Kern County could trade profitably with other regions and thereby acquire a substantial portion of the water necessary to make up the projected shortfall. The development of water markets would eliminate the need for some group or sector to incur uncompensated economic losses as a consequence of water scarcity and would remove existing inefficiencies in water use to the benefit of both water buyers and sellers. (See also W87-07690) (Geiger-PTT)
W87-07693

SATISFYING SOUTHERN CALIFORNIA'S THIRST FOR WATER: EFFICIENT ALTERNATIVES,
Department of the Interior, Washington, DC. Office of Policy Analysis.
R. W. Wahl, and R. K. Davis.
IN: Scarce Water and Institutional Change, Resources for the Future, Inc., Washington, DC, 1986. p 102-133, 3 fig, 7 tab, 26 ref.

Descriptors: *Water scarcity, *Water demand, *Water supply development, *Water shortage, *Water allocation, Water use, Institutions, Water law, Water policy, Water requirements, Water rights, Water supply, Water costs, Water transfer, Water management, Water conservation.

Los Angeles and the Metropolitan Water District of Southern California (MWD) draw water from the Los Angeles Aqueduct, the Colorado River Aqueduct, and the California aqueduct. The water supply is expected to drop by about 80,000 acre-feet by the year 2000 due to additional Indian claims, use of water by desert power plants, and a slight reduction in the State Water Project supplies. Alternatives for balancing supply and demand are discussed along with accompanying legal constraints, projected costs, and the amount of extra water that could be expected from each measure. The alternatives include: additions to the State Water Project, purchase of surplus water from the Federal Central Valley Project, demand management through pricing and drought management, conservation through investment in the Imperial Irrigation District (IID), and other minor alternatives such as building new storage facilities, lining canals, and conservation investments. The economic prospects for purchase of surplus water from the Federal Central Valley Project, demand management through pricing, and a transfer of water between the IID and the MWD are discussed. (See also W87-07690) (Geiger-PTT)
W87-07694

COSTS OF WATER MANAGEMENT INSTITUTIONS: THE CASE OF SOUTHEASTERN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W87-07695

INNOVATIONS IN WATER MANAGEMENT: LESSONS FROM THE COLORADO-BIG THOMPSON PROJECT AND NORTHERN COLORADO WATER CONSERVANCY DISTRICT,
Colorado Univ., Boulder. Dept. of Economics.
C. W. Howe, D. R. Schurmeier, and W. D. Shaw.
IN: Scarce Water and Institutional Change, Resources for the Future, Inc., Washington, DC, 1986. p 171-200, 3 fig, 4 tab, 18 ref.

Descriptors: *Water allocation, *Colorado, *Water costs, *Water demand, *Water law, Water transfer, Water supply development, Institutions, Water policy, Water shortage, Water scarcity, Water use, Water requirements, Water supply, Water use efficiency, Case studies, Water rights.

The Colorado-Big Thompson Project (C-BT) that transfers water from the western slopes of the Rocky Mountains to northeastern Colorado both required and inspired institutional innovation. The C-BT had to guarantee the repayment of project costs as required by Bureau of Reclamation laws,

negotiate solutions to conflicts with the basin of origin, and allocate water among users with varied water needs. These challenges led to the establishment in 1937 of the Northern Colorado Water Conservancy District (NCWCD). Much credit for the success of the C-BT must be given to the unusual system of water markets that evolved within the district and the set of legal and administrative conditions that made these markets possible. The major methods for allocating large water supplies within the market system are priority allocation rules and proportional rules. Under a priority rule, the various users are assigned certain quantities of water per time period, and each of these quantities has a priority number. A proportional rule divides available water among a group of users according to a fixed set of proportions. The total amount of C-BT water available to the district each year is determined by the quota system. In the C-BT-NCWCD system, return flows are owned by the district. When a buyer and a seller wish to effect an allotment transfer, they submit an application to the district. Transfers can sometimes be facilitated by brokers of NCWCD allotments. Rentals (transfers of water among users for one season only) occur not only with NCWCD water but also with appropriated and ditch company water. The water markets used by the NCWCD are more efficient than methods currently used by federal and state water agencies and might by copied for many places in the West and elsewhere. (See also W87-07690) (Geiger-PTT)
W87-07696

SAVING WATER IN A DESERT CITY,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 3D.
W87-07697

ECONOMIC VALUE OF INSTREAM FLOW: METHODOLOGY AND BENEFIT ESTIMATES FOR OPTIMUM FLOWS,
California Univ., Davis. Div. of Environmental Studies.
J. Loomis.
Journal of Environmental Management JEVMAW, Vol. 24, No. 2, p 169-179, March 1987. 1 fig, 2 tab, 20 ref.

Descriptors: *Instream flow, *Economic aspects, *Optimum flow, *Benefits, Estimating, Agriculture, Irrigation, Reserved flow.

Empirical estimation of the benefits of instream flow is a relatively new area of investigation in natural resource and agricultural economics. Drawing from techniques for estimating the economic efficiency benefits of non-marketed resources, several researchers have successfully established relationships between instream flow levels and benefits. The marginal values of instream flow vary significantly with level of flow, extreme values ranging from $0.50 to $74 per acre foot. However, most studies evaluated reported annual values between $14 and $27 per acre foot. Comparison of these typical benefits to average irrigation benefits indicates that reservation of instream flows can often be justified economically. (Author's abstract)
W87-08085

ROLE OF RIVERBANK FILTRATION ALONG THE RHINE RIVER FOR MUNICIPAL AND INDUSTRIAL WATER SUPPLY,
Technische Univ. Hamburg-Harburg (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W87-08153

COMMUNITY WATER SUPPLY IN DEVELOPING COUNTRIES: LESSONS FROM EXPERIENCE, EVALUATION SUMMARIES AND CONFERENCE FINDINGS,
Agency for International Development, Washington, DC.
For primary bibliographic entry see Field 5F.
W87-08234

WATER CONTROL STRATEGIES,
Corps of Engineers, Dallas, TX. Southwestern Div.
R. T. Coomes.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 119-121.

Descriptors: *Water resources development, *Water management, *Reservoir operation, Resources management, Water quality control, Water quality, Data interpretation, Resources development, Lakes, Reservoirs, Multipurpose reservoirs.

Because water control plans are based upon conditions which are expected to change over time, Corps of Engineers field offices are responsible for updating plans through continuing and progressive study. The need to evaluate water control strategies when water quality problems arise is discussed. The water control strategy depends first upon the latitude given the Corps of Engineers to make changes in the projects water control plan. The flexibility that the Corps used in the past to solve instream flow or water quality problems is rapidly being restricted by increasing demands upon the reservoir storage. The needs of various water supply customers, including recreation and power, are discussed. Methods of changing water control plans, including model simulations, environmental impact statements, and coordination agreement are described. (See also W87-08365) (Halterman-PTT)
W87-08378

WATER SUPPLY SIMULATION MODEL: ANALYZING FOR THE IMPLICATIONS OF CONSERVATION,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 3D.
W87-08445

6E. Water Law and Institutions

GREAT DISAPPEARING ACT OF USABLE AMERICAN WATER,
C. C. Urbano.
American Nurseryman, Vol. 163, No. 3, p 52-55, February 1986.

Descriptors: *Water shortage, *Drought, *Water supply, *Water quality, *Water policy, *Legislation, *Jurisdiction, Administrative agencies, State jurisdiction, Legal aspects, Public policy, Water management, Groundwater management, Groundwater pollution, Water pollution, Drinking water, Aquifers, Planning, Conservation, Water conservation, Costs, Economic aspects, Arizona.

About half of the drinking water in the United States is being depleted or contaminated; almost 60% of groundwater aquifers have disappeared in the past 60 years, and the rest may be gone in another 10 years, according to research attorney William A. Thomas of the American Bar Association, who has studied the status of U.S. water legislation. The central problem is that the country has a finite supply of groundwater, the source of about half the country's drinking water. Congress is currently considering two bills that would address the questions of groundwater depletion and contamination. The first would require each state to designate an agency to coordinate the state's water policies and submit plans for future projects. The other (less likely to pass) would direct the federal government to classify all aquifers and designate appropriate uses for each; several states have already adopted similar systems. However, federal action will not relieve state and local governments of their responsibilities for water conservation. Problems facing state and local agencies include high costs and water quality issues. It is concluded that legislators need the support of homeowners and business leaders, including landscapers and nursery and garden center owners. (Doria-PTT)
W87-07604

HEALTH AND REGULATORY CONSIDERATIONS,
California Dept. of Health Services, Berkeley. Sanitary Engineering Section.
For primary bibliographic entry see Field 3C.
W87-07672

LEGAL ASPECTS OF IRRIGATION WITH RECLAIMED WASTEWATER IN CALIFORNIA,
Hansen, Boyd, Culhane and Mounier, Sacramento, CA.
C. S. Richardson.
IN: Irrigation With Reclaimed Municipal Wastewater - A Guidance Manual, Lewis Publishers, Chelsea, Michigan. 1985. p 11-1 to 11-35, 86 ref.

Descriptors: *Impaired water use, *Legal aspects, *Wastewater irrigation, *California, *Water reuse, Reclaimed water, Liability, Legislation.

As reclaimed wastewater becomes a more significant part of the state water conservation program, legal disputes are likely to arise. The disputes presently foreseeable will come from conflicts over ownership of the reclaimed wastewater and over ambiguities in contractual obligations. Reclamation is a new use of a resource already heavily drawn upon. As water formerly returned to streams after use and treatment is withheld for resale at the treatment site, diminished flow downstream may deprive dependent users of their accustomed supply. Legal action has been taken to block one proposed sale of treated wastewater for this reason. This chapter focuses on two legal aspects of wastewater reclamation and reuse. The first section discusses the issues of water rights in the ownership and resale of reclaimed wastewater. The second section discusses potential liability and contractual provisions through which exposure to liability may be minimized. As in any area of the law, answers cannot be given with certainty. Until specific legal problems have been addressed by the courts through litigation, or in the legislature through statutes, their solutions can only be stated in probable terms. (See also W87-07662) (Lantz-PTT)
W87-07673

SCARCE WATER AND INSTITUTIONAL CHANGE.
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6D.
W87-07690

OVERVIEW,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6D.
W87-07691

COMPETITION BETWEEN IRRIGATION AND HYDROPOWER IN THE PACIFIC NORTHWEST,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6D.
W87-07692

WATER SCARCITY AND GAINS FROM TRADE IN KERN COUNTY, CALIFORNIA,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 6D.
W87-07693

SATISFYING SOUTHERN CALIFORNIA'S THIRST FOR WATER: EFFICIENT ALTERNATIVES,
Department of the Interior, Washington, DC. Office of Policy Analysis.
For primary bibliographic entry see Field 6D.
W87-07694

COSTS OF WATER MANAGEMENT INSTITUTIONS: THE CASE OF SOUTHEASTERN VIRGINIA,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
L. Shabman, and W. E. Cox.
IN: Scarce Water and Institutional Change, Resources for the Future, Inc., Washington, DC, 1986. p 134-170, 1 fig, 5 tab, 29 ref.

Descriptors: *Water management, *Water costs, *Institutions, *Virginia, *Water scarcity, Water shortage, Water demand, Water use, Water law, Case studies, Water supply, Water supply development, Water rights, Water transfer, Cost analysis, Water policy, Water supply systems, Water yield.

The water supply situation in southeastern Virginia is described to illustrate how economic inefficiency may result from instituional inadequacies. As a result of numerous studies aimed at solving the area's urban water supply problems, a proposal was made to construct a pipeline to transfer water from Lake Gaston in central Virginia to the Virginia Beach area. Challenges to implementation of this water supply alternative may be brought within administrative or court proceedings if it can be documented that socially unacceptable environmental impacts may occur under section 404 of the Clean Water, or if the project would interfere with water rights. An alternaitive to the pipeline, termed the conjunctive use alternative, would use the existing 49 mgd of groundwater capacity as a supplemental source, interconnect the Portsmouth and Norfolk water systems, develop a drought management plan, and expand current use of surface water from the Blackwater-Nottoway river system. The increase in capital cost of the Lake Gaston plan over the conjunctive use alternative is estimated at about $60 million. Despite the higher costs, the Lake Gaston alternative is still favored for political reasons over the conjunctive use plan; the Lake Gaston project would minimize the use of groundwater, need for drought management, the effect of projection error, and the possibility for successful challenges in court. The Virginia Beach case study suggests that three conditions are important for negotiating voluntary water transfers among affected parties. First, property rights to water must be assured. Second, transaction costs for bargaining and reaching an agreement must be low. Third, there must be adequate information about the scope and effects of the proposed transfer. Institutional reforms for achieving these goals are discussed. (See also W87-07690) (Geiger-PTT)
W87-07695

INNOVATIONS IN WATER MANAGEMENT: LESSONS FROM THE COLORADO-BIG THOMPSON PROJECT AND NORTHERN COLORADO WATER CONSERVANCY DISTRICT,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 6D.
W87-07696

FRAGMENTATION AND INTEGRATION IN STATE ENVIRONMENTAL MANAGEMENT,
Conservation Foundation, Washington, DC.
For primary bibliographic entry see Field 5G.
W87-07721

INTERNATIONAL JOINT COMMISSION: 1983-1984 ACTIVITIES REPORT.
International Joint Commission-United States and Canada, Windsor (Ontario).
International Joint Commission, Canada-United States, Windsor, Ontario. (1984). 99 p, 5 append.

Descriptors: *International commissions, *International agreements, *Canada, *United States, *Water quality management, Water law, Water policy, Water pollution prevention, Water management, International law, International waters, Water resources development, Environmental policy.

The work of the International Joint Commission, a permanent, binational body established under the provisions of the Boundary Waters Treaty of 1909 between the United States and Canada, is reported for the period 1983-1984. The Commission aided the negotiations which culminated in the signing of the Skagit River Treaty in April of 1984. This treaty put an end to a 42-yr dispute over Seattle's proposed raising of the High Ross Dam and consequent flooding of British Columbia lands. In 1984, the Commission completed its report on the diversions and consumptive uses of Great Lakes water. The Commission presented a report in 1983 on the effects of the operation of the Lake Erie-Niagara River Ice Boom. The Commission recommended that federal, state, and provincial governments take further steps to assure that better coastal zone management practices be followed to reduce flooding and erosion along Great Lakes shorelines. Specific recommendations were made for Lake Erie. Workshops conducted during the two-yr period covered the following topics: a transboundary monitoring network, ecological effects of in situ sediment contaminants, implementing the ecosystem approach, open lake disposal site selection, nonpoint source pollution problems, and bioassessment. The proceedings of the Indianapolis Great Lakes Water Quality Meeting in November 1983 are presented. The proposed restoration of the Grand Calumet River and the Indiana Harbor ship canal is discussed. In December 1984, the International Joint Commission completed its Second Biennial Report to Governments under the 1978 Great Lakes Water Quality agreement. The Council of Great Lakes research managers and new Great Lakes Regional Office director are listed along with appendices on Commission boards as of December 1984, executive meetings, public meetings on diversions and consumptive uses, applications and references, a directory of the Commission, and 1983-1984 Commission reports. (Geiger-PTT)
W87-07725

ECONOMIC-LEGISLATIVE ASPECTS OF DAKOTA GEOTHERMAL, SCOTTSBLUFF, NEBRASKA,
American Geothermal Energy Associates, Inc., Omaha, NE.
R. A. Guenther, and R. S. Sharpe.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 188-192, 1 fig, 5 tab, 8 ref.

Descriptors: *Dakota Aquifer, *Economic aspects, *Legislation, *Scottsbluff, *Nebraska, *Geothermal studies, *Aquifers, Dakota Aquifer, Water level, Geothermal resources.

Efforts to commercialize the geothermal resources of Nebraska led to feasibility studies for the heating of three building complexes in Scottsbluff, Nebraska, with geothermal energy. This involved geological and engineering studies. The building complexes are a college, a hospital and the high schools of Scottsbluff, Nebraska. The resource is assumed to be 180 F (82 C) water from aquifers 4,700 (1433 m) to 5,200 ft (1,585 m) below the surface; the static water level is expected to be about 2,000 ft (610 m) below the surface. Injection of the used fluids is anticipated. Problems of design, as well as the economics of utilizing this resource, are discussed. Various scenarios for heating the complexes are explored. The payback periods in terms of current energy prices range from nine to 32 years. Using projected fuel prices the payback periods range from six to 11 years. The most cost-effective project would be to heat the college and part of the hospital with geothermal energy. Work with the Legislature led to Legislative Bill (LB) 708, which defines the resource and makes it a mineral. LB 799 provides monies for the development of geothermal energy. (See also W87-07755) (Author's abstract)
W87-07777

POINDEXTER V. NICHOLS HILLS,
G. J. Swanson.
Water Well Journal WWJOA9, Vol. 41, No. 2, p 28-29, February 1987.

Descriptors: *Water law, *Legal aspects, *Poindexter, *Nichols Hills, *Oklahoma, *Permits, *Regulations, *Law enforcement, *Drilling, Domestic water.

David Poindexter, a drilling contractor from Oklahoma City, applied for a residential drilling permit to Nichols Hills municipality which was denied. The ground of denial was that in Oklahoma, municipalities have the right to regulate and/or permit wells to be drilled within their corporate jurisdiction. Mr. Poindexter challenged the validity of the ordinance based upon Oklahoma statute 8205-Section 1020.3, which states that a landowner has the right to take ground water for domestic use without a permit. Nichols Hills position was that the same statute 8205-Section 1020.21 makes an exception to the homeowner's right to take water from platted land within a municipality. Besides it is the responsibility of the municipality to make water available to all the residents within the platted land. District Judge Leamon Freeman of Oklahoma County ruled that a municipality's statutory authority to regulate the drilling of water wells within its boundaries cannot supersede a landowner's right to take ground water from land he owns. (Ray-PTT)
W87-07794

CLEAN WATER ACT RETURNS,
For primary bibliographic entry see Field 5G.
W87-07817

GROUNDWATER RECHARGE WITH RECLAIMED WASTEWATER: LEGAL QUESTIONS IN CALIFORNIA,
Downey, Brand, Seymour and Rohwer, Sacramento, CA.
For primary bibliographic entry see Field 4B.
W87-08161

ACID RAIN AND TRANSPORTED AIR POLLUTANTS: IMPLICATIONS FOR PUBLIC POLICY.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 5B.
W87-08208

WATER LAW: IMPACT ON CONSERVATION,
Virginia Water Resources Research Center, Blacksburg.
W. R. Walker.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 17-26, 7 ref.

Descriptors: *Water law, *Water conservation, *Legal aspects, Riparian rights, Flow patterns, Water use, Water rights.

Laws with respect to water are unusual because they may vary depending on the form in which water is found. The subject is further complicated because the states do not have uniform water laws. Water with bed and bank in the western United States must conform to the prior appropriation doctrine which places emphasis on the protection of private property rights rather than maximum utilization. Water in this same form in the East is governed by the riparian doctrine which defines the water rights according to the place of use. Water under the ground may follow the English, American, or reasonable use rule. Diffused water which flows over the surface of the ground must be captured to establish a right. All of these laws evolved generally for historical reasons and have been modified slightly by statutes but not uniformly. None were designed to reduce consumption, promote efficiency or facilitate change to a higher beneficial use. The development of constitutionally protected water rights has made change more difficult. Yet these laws and the institutional structures which have evolved to implement them must be modified to promote greater use of a finite resource. (See also W87-08420) (Author's abstract)
W87-08421

WATER CONSERVATION IN ARIZONA: PAST, PRESENT, AND FUTURE,
Arizona State Dept. of Health Services, Phoenix.

Bureau of Water Quality Control.
For primary bibliographic entry see Field 3D.
W87-08435

NEED FOR A NEW FEDERAL WATER POLICY,
New York City Dept. of Environmental Protection.
F. X. McArdle.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 409-412.

Descriptors: *Water policy, *Public policy, *Water resources development, Economic aspects, Federal jurisdiction, Local governments.

Federal water policy, such as it has been, has addressed the supply-demand nexus very narrowly, focusing almost exclusively on developing new supplies for agricultural and natural resource exploitation in the South and the far West. That policy must change focus to meet national needs as well as regional needs. And it must address the demand side of the equation as well as the supply side. Most cities haven't had the advantage of a near-by federal project to help them reduce their own new supply costs. And there has been no help with demand-side issues. Systematic replacement and rehabilitation can offset new supply needs. Conservation management is another tool that must be exploited along with reuse approaches. There has been little federal help here. There must be a new federal water policy. It must meet all urban needs as well as rural ones. But ultimately,it must be a program that focuses program implementation and direction at the local level. Any other program focus will result in delays in implementation; will result in a failure to develop maximum local consensus; and will ignore the critical expertise at the local level. The need for such a rational, national approach to water policy is most clearly evident at the federal level. The debate in the efforts of many agencies over the past years must move forward, and the issues that must be addressed are clear. First, there must be a national program. If programs cannot be built that satisfy all regions in the differing elements that affect their supply/demand equations for both quantity and quality, then there will be little progress made. Second, there can no longer be sectoral discrimination in federal water supply programs in both the development and the pricing of new supply. There is no longer a rationale for treating agricultural water development differently than one treats the development of new supply for municipal and industrial uses. There should be full cost pricing so that real economic cost/benefit analyses can be undertaken. Third, the focus of any national water policy must be local and cooperative. Finally, in any national water policy, the supply and demand sides of the equation must be treated equally in both focus and financing. (See also W87-08420) (Lantz-PTT)
W87-08461

POLLUTION ACROSS BORDERS: ACID RAIN - ACID DIPLOMACY.
New Hampshire Univ., Durham. Dept. of Forest Resources.
For primary bibliographic entry see Field 5B.
W87-08497

INTERNATIONAL ASPECTS OF ACID RAIN: WHERE DO WE STAND,
Institute of European Environmental Policy, Bonn (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W87-08498

NORDIC PERSPECTIVE OF ACID RAIN: SWEDEN,
Royal Ministry for Foreign Affairs, Stockholm (Sweden).
For primary bibliographic entry see Field 5B.
W87-08500

EUROPEAN NATIONAL RESPONSES TO THE EXPANDING PROBLEM OF ACID RAIN,
Pioneer Foundation, Inverness, CA.
For primary bibliographic entry see Field 5B.
W87-08501

CANADIAN DIPLOMATIC PERSPECTIVE OF ACID RAIN,
Consul General of Canada in New England, Boston, MA.
For primary bibliographic entry see Field 5B.
W87-08502

U.S. EPA PERSPECTIVE OF ACID RAIN,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5B.
W87-08503

US DIPLOMATIC PERSPECTIVE OF ACID RAIN,
Department of State, Washington, DC. Office of Canadian Affairs.
For primary bibliographic entry see Field 5B.
W87-08504

GOVERNOR'S PERSPECTIVE ON ACID RAIN,
National Governor's Association, Washington, DC. Acid Rain Task Force.
For primary bibliographic entry see Field 5B.
W87-08506

VERMONT PERSPECTIVE ON ACID RAIN,
Vermont State Agency of Environmental Conservation, Montpelier.
For primary bibliographic entry see Field 5B.
W87-08507

ONTARIO PERSPECTIVE ON ACID RAIN,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5B.
W87-08508

CONGRESSMAN'S PERSPECTIVE ON ACID RAIN,
For primary bibliographic entry see Field 5B.
W87-08509

SCOTTISH BURN,
Dundee Coll. of Technology (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W87-08530

MEDITERRANEAN ACTION PLAN: A REGIONAL APPROACH TO POLLUTION CONTROL,
World Health Organization, Athens (Greece). Coordinating Unit for the Mediterranean Action Plan.
For primary bibliographic entry see Field 5G.
W87-08558

LEGAL AND ADMINISTRATIVE ASPECTS OF THE TREATMENT AND DISCHARGE OF INDUSTRIAL WASTEWATERS IN THE MEDITERRANEAN,
World Health Organization, Athens (Greece). Coordinating Unit for the Mediterranean Action Plan.
For primary bibliographic entry see Field 5G.
W87-08559

TRANSFERABILITY OF INDIAN WATER RIGHTS,
Nevada Univ., Reno. Dept. of Civil Engineering.
J. W. Bird.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 317-322, May 1987. 13 ref.

Descriptors: *Legal aspects, *Native Americans, *American Indians, *Water rights, Reservations, Transferability.

There is interest in the possibility of purchasing Indians' reserved water rights to use either on or off the reservation for various purposes. Those wishing to purchase such reserved rights should examine the law closely, since it appears that the courts will not allow those reserved rights to be transferred from the reservation lands. (Author's abstract)
W87-08590

6G. Ecologic Impact Of Water Development

ASSESSING THE HEALTH OF THE OCEANS: AN INTERNATIONAL PERSPECTIVE,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Lab.
For primary bibliographic entry see Field 5G.
W87-07650

ENVIRONMENTAL IMPACT OF WATER RESOURCES PROJECTS,
Oklahoma Univ., Norman. Environmental and Ground Water Inst.
L. W. Canter.
Lewis Publishers, Inc., Chelsea, Michigan. 1985. 352 p.

Descriptors: *Environmental impact statement, *Ecological effects, *Environmental effects, *Dam effects, *Water resources development, Irrigation effects, Water pollution effects, Locks, Risks, Literature review, Decision making, Project planning, Fate of pollutants, Dredging.

This book summarizes information from key technical literature related to the implementation of environmental impact studies for water resources development projects. It is organized into five chapters and 16 appendices. Following an introductory chapter focusing on summary data from 434 included references, chapters 2 through 4 discuss environmental impact studies for dam and reservoir projects, channelization projects, and dredging projects, respectively. Chapter 5 addresses some other project types such as irrigation and shoreline structures. Abstracts of the 434 included references are divided into 16 appendices as follows: impacts of impoundment projects; impacts of channelization projects; impacts of dredging projects; impacts of other water resources projects; impacts of nonpoint sources of pollutants on water environment; transport and fate of pollutants in the water environment; baseline studies of the water environment; environmental indices and indicators; water quantity/quality impact prediction and assessment; biological impact prediction and assessment; estuarine impact prediction and assessment; groundwater, noise, cultural, visual, and socio-economic impact prediction and assessment; methodologies for trade-off analyses and decision-making; public participation in water resources planning; impact mitigation measures; and related issues and information. (Geiger-PTT)
W87-07700

HOHOKAM SETTLEMENT ALONG THE SLOPES OF THE PICACHO MOUNTAINS RESEARCH DESIGN, TUCSON AQUEDUCT PROJECT,
Museum of Northern Arizona, Inc., Flagstaff.
D. E. Weaver, R. Ciolek-Torrello, and J. S. Bruder.
MNA Research Paper 35, Vol. 1, Museum of Northern Arizona, Flagstaff, Arizona, 1986. 116 p, 3 fig, 7 tab, 176 ref, append. BuRec Contract 3-CS-30-00790, Project A-83-40.

Descriptors: *Environmental impact statement, *Central Arizona Project, *Environmental effects, *Aqueducts, *Archaeology, Water supply development, Project planning, Design criteria, Ecological effects.

This research design focuses upon proposed archaeological studies at 34 Hohokam sites potentially subject to impact, both direct and indirect, as a consequence of the construction of Tucson Aqueduct, Reaches 1 and 2, extending from just east of

Picacho Reservoir to the vicinity of Red Rock, Arizona. The sites involved include small shard and lithic scatters, possible field houses, villages, possible canals, field areas, trash mounds, a reservoir, compounds, and platform mounds. The survey data indicates occupation in both the pre-Classic and Classic periods, with the major occupation in the Classic period. The design discusses site specific and regional settlement patterns and subsistence strategies, and changes through time, as the primary foci of research. Specific field strategies, as well as laboratory procedures, are outlined and a detailed work plan is presented. Implementations of the research design will produce important contributions to the understanding of the regional Hohokam development. (See also W87-07705) (Author's abstract)
W87-07704

TUCSON AQUEDUCT - PHASE A, HOHOKAM ARCHAEOLOGICAL SITES CULTURAL MITIGATIVE DATA RECOVERY STUDIES, CENTRAL ARIZONA PROJECT: 1984/1985 ANNUAL REPORT,
Museum of Northern Arizona, Inc., Flagstaff.
D. E. Weaver, and R. Ciolek-Torrello.
1986. 3 fig, 21 tab, 37 ref. BuRec Contract 3-CS-30-00790.

Descriptors: *Aqueducts, *Central Arizona Project, *Project planning, *Environmental impact statement, *Archaeology, Water supply development, Water resources development, Ecological effects, Environmental effects, Design criteria.

This report summarizes the second year of archaeological studies for the Tucson Aqueduct-Phase A Hohokam sites. A part of the Central Arizona Project, the work was carried out by Museum of Northern Arizona personnel under contract to the U. S. Bureau of Reclamation. The report summarizes the work accomplished, reviews preliminary research results, suggests modifications to the project research design, and presents a work plan for the third year of the project. The work accomplished in the second contract year at the Brady Wash complex has not altered the basic understanding of Hohokam development along Brady Wash derived from work in the first contract year. In the vicinity of the Picacho complex, work was concentrated on the Red Rock Reservoir, the McClellan Wash site and the Picacho Pass site. Data gathered indicate considerable differences between the Picacho complex and the Brady Wash complex. The work accomplished in the Picacho area has provided valuable information about subsistence activities, social organization, and exchange networks, and the nature and causes of the changes in Picacho Hohokam society during the Colonial, Sedentary and Classic periods. (See also W87-07704) (Geiger-PTT)
W87-07705

RIVERTON ROCK ART STUDY, FREMONT COUNTY, WYOMING,
P-III Associates, Inc., Salt Lake City, UT.
B. L. Tipps, and A. R. Schroedl.
Cultural Resources Report 409-1-8501, March 1985. 8 fig, 6 tab, 67 ref, 8 append. Contract 4-PG-60-18070.

Descriptors: *Archaeology, *Reservoirs, *History, *Rocks, *Wyoming, River basins, Project planning, Environmental impact statement, Land reclamation.

At the request of the Bureau of Reclamation, Upper Missouri Regional Office, P-III Associates, Inc., undertook a study of 17 known rock art sites located in the Shoshone Basin of central Wyoming. Eleven of the 17 sites were located in the field, and the remaining six sites could not be located; they were apparently inundated by Boysen Reservoir. One of the sites was situated on the Wind River Indian Reservation and permission to visit the site could not be obtained. The remaining ten sites that were evaluated contained 22 separate panels and 97 indentifiable figures, all petroglyphs. Four of the sites which were representative examples of rock art sites in the Shoshone Basin were nominated to the National Register of Historic Places. (Geiger-PTT)
W87-07706

ARCHAEOLOGICAL INVESTIGATIONS IN THE SOUTHERN SECTION OF THE GARRISON DIVERSION UNIT IN NORTH DAKOTA, 1984,
North Dakota Univ., Grand Forks. Dept. of Anthropology and Archaeology.
M. L. Gregg, C. Kordecki, and P. R. Picha.
Contribution 219, Department of Anthropology, University of North Dakota, Grand Forks, North Dakota, December 1985. 39 fig, 47 tab, 144 ref, 3 append. BuRec Contract 4-CS-60-00630.

Descriptors: *Archaeology, *Flood plains, *Environmental impact statement, *History, *James River, Rivers, Water resources development, Fluvial sediments.

Nine prehistoric archeological sites along the James River in Stutsman and LaMoure counties and three around Kraft Slough in Dickey County, North Dakota, were investigated to produce significance evaluations in terms of National Register of Historic Places eligibility criteria and/or to determine site limits. Most of the investigated site areas along the James River are in flood plain settings where artifact deposits have been found buried beneath alluvium up to 3.0 m below the present ground surface. The flood plain has generally been aggrading since the mid-Holocene, capping successive living surfaces in the valley bottom. Most investigated sites have been repeatedly occupied and contain vertically stratified artifact deposits. Site extents were determined through a combination of surface inspection and auger probing. By screening auger probe sediments, artifacts were recovered from shallow, subsurface, high density cultural deposits, and site areas were determined to range from 1.4 ha (3.4 acres) to 24.5 ha (60.5 acres). Flood plain areas were recurrently occupied from the Middle Plains Woodland period (100 B.C.-A.D. 600) through the Late Plains Woodland period (A.D. 600-900), Early Plains Village period (A.D. 900-1400), and Late Plains Village period (A.D. 1400-1750). Stratified, ceramic bearing sites such as those investigated by this project are important in Northeastern Plains prehistory. (Author's abstract)
W87-07707

RESEARCH DESIGN AND WORK PLAN FOR CULTURAL RESOURCE STUDIES IN THE DISTRIBUTION DIVISION OF THE CENTRAL ARIZONA PROJECT,
Northland Research, Inc., Flagstaff, AZ.
W. S. Marmaduke.
Report No. DI-BR-APO-CCRS-86-8, 1984. Northland Research, Inc., Flagstaff, Arizona. 132 p, 4 fig, 2 tab, 208 ref, append. Contract 3-PA-30-00740, Task 2.

Descriptors: *Archaeology, *Water resources development, *Central Arizona Project, *Project planning, Water conveyance, Environmental effects, Environmental impact statement, Water distribution.

A research design for a Class III Cultural Resources survey and also for potential, subsequent mitigation studies in the Distribution System of the Central Arizona Project is presented. The archaeological work will focus on mostly small, prehistoric sites from widely scattered locations in the Gila Basin. Considerations of knowledge, explanation, and archaeological research as forms of scientific inquiry are discussed. Regional systems (Archaic, Hohokam, Protohistoric and Historic Periods), data collection and interpretation, research methods, and administrative planning are presented. (Geiger-PTT)
W87-07723

PETROGLYPHS OF THE PICACHO MOUNTAINS, SOUTH CENTRAL, ARIZONA,
Institute of American Research, Tucson, AZ.
H. D. Wallace, and J. P. Holmlund.
Anthropological Papers 6, 1986. 243 p, 85 fig, 16 tab, 59 ref.

Descriptors: *Environmental impact statement, *Central Arizona Project, *Archaeology, Aqueducts, Water supply development, Project planning, Environmental effects.

This report presents the results of an intensive archaeological study of petroglyph sites in the Picacho Mountains of South Central, Arizona. Twelve sites with a total of 4,152 recorded designs are considered. A sample survey of the foothills of the Picacho Mountains and previous research performed by the authors at 31 additional petroglyph sites in the Tucson Basin and Samaniego Hills provide contextual information and a substantial comparative data base. This study comprises one aspect of the archaeological mitigation program concerned with Phase A of the Tucson Aqueduct Project. (Author's abstract)
W87-07727

FINAL REPORT FOR PLAN 6 SUPPLEMENTAL CULTURAL RESOURCE SURVEYS,
Archaeological Consulting Services Ltd., Tempe, AZ.
M. Green, and R. W. Effland.
Available from the National Technical Information Service, Springfield, Virginia, 22161, as DE84 005102. Price codes: A04 in paper copy; A01 in microfiche. Cultural Resource Report 37, November 1985. 228 p, 1 fig, 1 tab. Bureau of Reclamation Project Nos. PO 5-PB-32-03440, and PO 5-PG-32-25190.

Descriptors: *Archaeology, *New Waddell Dam, *Social impacts, *Arizona, *Surveys, Geology, Water resources development, Damsites, Dams.

This final report reflects a year of on-call class III cultural resource survey for Plan 6, the Regulatory Storage Division of the Central Arizona Project. Included are eight reports representing close to 6000 acres of survey performed in the vicinity of the planned New Waddell Dam. Because New Waddell Dam is designed to be rock filled, one of the focal points of the survey was to examine proposed sources of the borrow material. A second focus was on ancillary water control features. The tasks included survey of 11 locations for geologic test trenches in the proposed Black Mountain Rock Quarry; survey of the proposed relocation route for a portion of the Castle Hot Springs Road; survey of the proposed Waddell Canal and Agua Fria Borrow Area; survey of a geologic test trench and small materials pit near the confluence of Mesquite Wash and Sycamore Creek; relocation and flagging of six previously recorded sites; survey of the Morgan City Wash Spillway; survey of the New River Borrow Area; survey of the Black Mountain Material Areas; and survey of the East Terrace Borrow Area. These surveys yielded a total of 43 sites and 2018 loci of isolated artifacts. All but one of the sites were located in the two largest study areas, the Agua Fria and New River Borrow Areas. Although separated by only 2.5 milles, these two study areas evidence obvious differences in degree of use for habitation, agricultural strategies practiced, and artifact assemblages. Hypotheses concerning these divergences are suggested for testing during the upcoming data recovery program. Recommendations of site significance and strategies for avoidance or mitigation are offered. (Author's abstract)
W87-07754

ECOSYSTEM ALTERATION OF BOREAL FOREST STREAMS BY BEAVER (CASTOR CANADENSIS),
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2E.
W87-07972

DESERTIFICATION PROCESSES AND IMPACT IN RAINFED AGRICULTURAL REGIONS,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
D. W. Sanders.
Climatic Change CLCHDX, Vol. 9, No. 1/2, p 33-42, August-October 1986. 7 ref.

Descriptors: *Desertification, *Ecological effects, *Agriculture, *Arid lands, *Rainfall, Crop production, Salinization, Erosion, Soil erosion, Wind erosion, Organic matter, Soil organic matter, Contamination, Water pollution, Salinity, Vegetation effects, Cultivation, Toxicity, Agricultural chemicals, Saline soils, Soil types.

The processes of desertification are reviewed. About one third of the Earth's land surface lies in the arid and semi-arid regions; this area not only supports 600 million people, but produces much of the world's grain and a substantial amount of animal produce. Much of this area is now either suffering or is threatened by the processes of desertification. Seven different desertification processes are described: degradation of vegetative cover, wind erosion, water erosion, salinization, soil crusting and compaction, reduction in organic matter, and accumulation of toxic substances are identified and their effects described. It is pointed out that these processes are usually closely interrelated, the one frequently leading to one or more of the others. Whatever the process, the end result is degraded land with a reduced productive capacity. It is concluded that desertification occurs through man's influence on the environment, and that the problems of desertification cannot be solved by considering only physical processes. (Author's abstract)
W87-07993

DESERTIFICATION PROCESSES AND IMPACTS IN IRRIGATED REGIONS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
R. A. Perry.
Climatic Change CLCHDX, Vol. 9, No. 1/2, p 43-47, August-October 1986. 3 ref.

Descriptors: *Desertification, *Irrigation effects, *Irrigable land, *Ecological effects, *Watershed management, *Land management, Arid zones, Deserts, Drought, Rainfall, Catchment areas, Sedimentation, Canals, Water quality, Waterlogging, Salinization, Saline soils, Soil types, Irrigation, Irrigation practices, Groundwater level, Water table rise, Costs, Political constraints, Economic aspects, Social aspects.

The problem of desertification in irrigated regions is reviewed. It is concluded that desertification in irrigated regions results from man's activities, although it may be more rapid in periods of drought or abnormally high rainfall. Causes include sedimentation of canals, use of poor quality water, or waterlogging or salinization because of rising groundwater tables caused by excessive applications of irrigation water. It can be avoided by good land management in catchments and irrigation areas, although social, economic, and political constraints exist. Direct costs due to loss of production from affected lands are less than indirect costs to national economies. (Author's abstract)
W87-07994

DROUGHT STRATEGIES IN EAST AFRICA: THE CLIMATOLOGIST'S ROLE,
University of East Anglia, Norwich (England). Climatic Research Unit.
For primary bibliographic entry see Field 2B.
W87-07995

WEAVER BOTTOMS TARGETED FOR RESTORATION,
Upper Mississippi River National Wildlife and Fish Refuge, Winona, MN.
A. Hawkins.
Fish and Wildlife News, p 8-9, April-May 1986.

Descriptors: *Weaver Bottoms, *Mississippi River, *Conservation, *Erosion control, *Marshes, *Environmental policy, *Backwater, Sedimentation rates, Recreation, Economic aspects, Marshes, Cropland, Agriculture, Erosion, Mud flats, Habitats, Wildlife habitats, Dam effects, Flooding, Wildlife conservation, Fish conservation, Dredging, Water quality, Water quality management, Planning, Environmental protection, Environmental quality, Social aspects.

The backwaters of the Upper Mississippi River are the target of cooperative efforts by state and federal agencies to implement recommendations of a 1970s environmental study known as the Great River Environmental Action Team (GREAT). The first large-scale habitat restoration effort in the area is scheduled for summer 1986 at Weaver Bottoms, a 4,000-acre waterfowl marsh where deposition of dredged materials for channel maintenance has been cutting off and filling in backwater habitats. The outstanding feature of the restoration project is that construction resulting in habitat improvement will be accomplished by the U.S. Army Corps of Engineers at no cost to the U.S. Fish and Wildlife Service. The cooperating agencies have determined that using dredged material for rehabilitating Weaver Bottoms is economically justified and provides a balance of economic, environmental, and social values in the best public interest. (Doria-PTT)
W87-08007

HARBOR IMPACTS AT SAVANNAH REFUGE,
Habitat Resources, Atlanta, GA.
J. D. Brown.
Fish and Wildlife News, p 19, April-May 1986.

Descriptors: *Savannah Refuge, *Wildlife conservation, *Harbors, *Environmental effects, *Model studies, *Planning, Conservation, Habitats, Wildlife habitats, Dredging, Vegetation, Fish, Bass, Water pollution, Wetlands, Rivers, Trout, Navigation, Channel improvement, Channels, Diversion channels, Administrative agencies.

In late 1985, work began on the U.S. Fish and Wildlife Service's Lower Savannah River Study, designed to determine the impact that future development at Savannah Harbor might have on the fish and wildlife of adjacent Savannah Refuge and to evaluate the effectiveness of potential mitigation measures. The study includes development of a habitat/successional model, an analysis of past vegetational changes, an investigation of the impacts on the spawning and nursery habitats of striped bass, and a survey of contaminant residues. The study will take almost three years to complete, but is expected to provide answers that will be useful far into the future. (Doria-PTT)
W87-08008

SERVICE ACTIVE IN CHESAPEAKE RESTORATION,
Ecological Services, Annapolis, MD.
For primary bibliographic entry see Field 5G.
W87-08009

EFFECTS OF BARGE TRAFFIC ON DISTRIBUTION AND SURVIVAL OF ICHTHYOPLANKTON AND SMALL FISHES IN THE UPPER MISSISSIPPI RIVER,
National Fishery Research Lab., La Crosse, WI.
L. E. Holland.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 1, p 162-165, January 1986. 2 fig, 1 tab, 12 ref.

Descriptors: *Barges, *Ecological effects, *Upper Mississippi River, *Survival, *Ecological distribution, *Fish populations, Transportation, Navigation, Distribution, Spatial distribution, Density, Population density, Plankton, Populations, Eggs, Fish eggs, Growth stages, Larval growth stage, Trawling, Navigable waters, Rivers, Economic aspects, Cost-benefit analysis, Bottom water, Surface water.

Short-term impacts of commercial barge traffic on eggs, larvae, young-of-the year (age-0), and small adult fish in the main channel of the Upper Mississippi River were evaluated by monitoring mortality and changes in distribution on the basis of samples taken at a fixed point before (control) and after passage of a vessel. Barge passages were found to cause significant changes in the distribution of eggs and larvae in the study area. The mean catch of ichthyoplankton was reduced in both surface and bottom waters for 90 min after passage of vessels (generally loaded barges) downstream. The effects of upstream traffic (unloaded barges) on catch ranged from none in surface or bottom samples to short-term increases in surface samples immediately after passage. No consistent effect on the catch of age-0 or small adult fishes in surface or bottom trawls was evident. Physical damage to eggs, but not to larvae or small fish, was significant. It is concluded that if commercial navigation increases on the river, significant mortality of early life stages would result. (Author's abstract)
W87-08044

ENVIRONMENTAL IMPACT OF WATER RESOURCES PROJECTS,
Oklahoma Univ., Norman. Environmental and Ground Water Inst.
L. W. Canter.
Lewis Publishers, Inc., Chelsea, MI. 1985. 352 p.

Descriptors: *Environmental effects, *Water resources development, Reservoirs, Dams, Channeling, Estuaries, Dredging, Ecological effects.

Water resources projects such as dams and reservoirs, channelization, and dredging can represent large-scale engineering works or activities which can cause significant inmpacts on physical-chemical, biological, cultural, and socio-economic components of the environment. Environmental impact studies for such projects should be planned and conducted in a scientifically defensible manner. This book summarizes information from key technical literature related to the implementation of such studies. These studies should be conducted in a manner so as to yield projects which are more compatible with the environment. All too often, environmental impact studies have been used to delay or stop projects. This book is organized into five chapters and 16 appendices. Following an introductory chapter which focuses on summary information from 434 included references, Chapters 2 through 4 are related to environmental impact studies for dam and reservoir projects, channelization projects, and dredging projects, respectively. Chapter 5 addresses some other project types such as irrigation and shoreline structures. Abstracts of the 4343 included references are divided into 16 appendices as follows: impacts of impoundment projects; impacts of channelization projects; impacts of dredging projects; impacts of other water resources projects; impacts of nonpoint sources of pollutants on water environment; transport and fate of pollutants in the water environment; baseline studies of the water environment; environmental indices and indicators; water quantity/quality impact prediction and assessment; biological impact prediction and assessment; estuarine impact prediction and assessment; groundwater, noise, cultural, visual, and socio-economic impact prediction and assessment; methodologies for trade-off analyses and decision-making; public participation in water resources planning; impact mitigation measures; and related issues and information. (Lantz-PTT)
W87-08164

ASSESSING THE EFFECTS OF CONTAMINANTS ON THE STRUCTURE AND FUNCTION OF AQUATIC ECOSYSTEMS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W87-08182

MISSISSIPPI RIVER CULTURAL RESOURCES SURVEY, A COMPREHENSIVE STUDY, PHASE I, COMPONENT A: THEMATIC HISTORICAL OVERVIEW,
National Park Service, Denver, CO. Denver Service Center.
J. A. Greene, A. B. Clemenson, J. C. Paige, D. R. Stuart, and L. F. Van Horn.
Available from the National Technical Information Service, Springfield, Virginia 22161, as AD-A145600. Price codes A16 in paper copy and A01 in microfiche. Army Corps of Engineers Report No. PD-RC-84-05, May 1984. 352 p, 8 fig, 480 ref. Department of the Army Contract No. DA2544, LMNPD-82-20.

Descriptors: *Mississippi River, *History, *Archaeology, *Surveys, Louisiana, Geography.

The study is an anthropological overview summarizing historic records and archaeological literature for use by historic preservationists and cultural resource managers in Southeastern Louisiana, and is essentially threefold: (1) to provide a research design that will facilitate future cultural resources investigations within designated Corps of Engineers project areas; (2) to provide the basis for identification, description, and evaluation of known cultural resources along the lower Mississippi River; and (3) to provide management with direction in undertaking future Corps-related projects affecting cultural resources. Geographical parameters of this study, consisted of all lands associated with and contiguous to the present channel of the Mississippi River between ca. River Mile 330 Above Head of Passes and the Gulf of Mexico. Designated lateral confines were established at 500 meters landward of existing or projected levees and low water lines on either side of the river. (Lantz-PTT)
W87-08198

DIRTY DEVIL SALINITY PROJECT CLASS III CULTURAL RESOURCE INVENTORY, EMERY AND WAYNE COUNTIES, UTAH,
Complete Archaeological Service Associates, Cortez, CO.
N. S. Hammack.
Four Corners Archaeological Project Report No. 2, July 15, 1985. 36 p, 27 fig, 19 ref. BuRec Contract 4-CS-40-01650.

Descriptors: *Dirty Devil Salinity Project, *Utah, *Emery County, *Wayne County, *Archaeology, Injection wells, Collection wells.

A Class III cultural resource inventory of 45 miles of linear right-of-way and three 80 acre blocks was carried out in central Utah, for the Bureau of Reclamation. This project involves proposed transmission line corridors, pipelines, and access roads to the collection wells and surface facility and injection well sites at the Emery South Salt Wash and Hanksville Salt Wash portions of the Dirty Devil Salinity Project. During this inventory, three new sites were recorded and five isolated flaked lithic artifacts were located. The proposed project will also involve five previously recorded sites. The three newly recorded sites include two camp sites with deflated hearths and lithic scatters, and one lithic scatter. None of these sites can be identified as to age or cultural affiliation and none are considered to be eligible for nomination to the National Register of Historic Places. (Author's abstract)
W87-08201

CLASS III INVENTORY MCPHEE RESERVOIR BOUNDARY FENCE AND HOUSE CREEK RECREATION AREA POWERLINE, MONTEZUMA COUNTY, COLORADO,
Complete Archaeological Service Associates, Cortez, CO.
S. L. Fuller.
Four Corners Archaeological Project Report No. 5, January 13, 1986. 19 p, 6 fig, 4 tab, 6 ref, 2 append. BuRec Contract 4-CS-40-01650.

Descriptors: *McPhee Reservoir, *House Creek Recreation Area, *Montezuma county, *Colorado, *Archaeology, History, Surveys.

A Class III cultural resource inventory of approximately eight miles of 150 foot wide linear right-of-way was conducted in the vicinity of the Bureau of Reclamation Dolores Project in southwest Colorado. The inventory was for a segment of the McPhee Reservoir boundary fence and a segment of the House Creek Area powerline. During this inventory, three new sites were recorded. Also, three previously recorded sites were relocated in these project areas. These six sites include five prehistoric sites and one historic site. Two of the previously recorded sites are currently on the National Register of Historic Places and the third previously recorded site has been determined to be ineligible for inclusion on the Register. The three newly recorded sites are recommended as being eligible for nomination to the National Register of Historic Places. (Author's abstract)
W87-08202

MONITORING AND EXCAVATION AT AULSTON PUEBLO (SITE 5MT2433), A PUEBLO II HABITATION SITE,
Complete Archaeological Service Associates, Cortez, CO.
J. N. Morris.
Four Corners Archaeological Project Report No. 6, March 15, 1986. 86 p, 23 fig, 4 tab, 56 ref, 5 append. BuRec Contract 4-CS-40-01650.

Descriptors: *Monitoring, *Aulston Pueblo, *Yellow Jacket, *Colorado, *Archaeology, History, Excavation, Water resources development, Anasazi.

Aulston Pueblo, Site 5MT2433, is an Anasazi habitation site located approximately 7.2 km southwest of Yellow Jacket, Colorado. The site lies in several cultivated fields, and surface evidence of prehistoric structures is scarce. Ceramic data from a survey surface collection indicate that several components are present at Aulston Pueblo. Excavation and construction monitoring were conducted at the site for the Bureau of Reclamation, to mitigate the construction impact of the Dolores Project. Excavation was restricted to the pipeline right-of-way, thus most of the site remains uninvestigated. Within the right-of-way, two Pueblo II period (A.D. 900 to 1100) pitstructures were excavated and three exterior pits were recorded. Pitstructure 1 (a kiva) is dated to the A.D. 1040's by tree-ring dating samples. Pitstructure 2 (a mealing room) is possibly contemporaneous with Pitstructure 1. The three exterior pits are poorly dataed and are spatially unrelted to Pitstructures 1 and 2. (Author's abstract)
W87-08203

CULTURAL RESOURCE INVENTORY FOR THE TOWAOC CANAL PROJECT: HIGHLINE DITCH, LOWER HERMANA LATERAL, ROCKY FORD LATERALS, AND PORTIONS OF THE UPPER HERMANA AND LONE PINE LATERALS,
Complete Archaeological Service Associates, Cortez, CO.
K. A. Kuckelman.
Four Corners Archaeological Project Report No. 8, July 20, 1986. 192 p, 129 fig, 8 tab, 36 ref, append. BuRec Contract 4-CS-40-01650.

Descriptors: *Towaoc Canal, *Colorado, *Surveys, *McElmo Creek, *Archaeology, History, Salinity, Pueblo.

A Class III cultural resources inventory was carried out to locate and identify archaeological resources within 48.5 linear miles of corridors along the route of the proposed Towaoc Canal and associated laterals. These data are being provided for a supplemental Environmental Impact Statement, which is required because the Towaoc Canal and the McElmo Creek salinity features of the Dolores River Project have been combined and the route of the proposed canal consequently has been changed. These data will be used by the United States of Bureau of Reclamation during the final planning stages of the construction of the canal and its associated laterals. The survey area is in the southwestern corner of Colorado, near the town of Cortez. One hundred three sites and 12 isolated finds were recorded during this survey, and 97 additional sites have been previously recorded within 1 km of the survey corridors. The temporal span of the prehistoric sites ranges from Archaic to Pueblo III; 10 historic sites were also recorded. Ninety-six of the 103 newly recorded sites meet the eligibility requirements for the National Register of Historic Places; none of the previously or newly recorded sites are currently on the National Register. (Author's abstract)
W87-08204

ARCHAEOLOGICAL EXCAVATIONS ON REACH II OF THE DOVE CREEK CANAL,
Complete Archaeological Service Associates, Cortez, CO.
J. N. Morris.
Four Corners Archaeological Project Report No. 9, September 12, 1986. 153 p, 47 fig, 5 tab, 49 ref, 6 append. BuRec Contract 4-CS-40-01650.

Descriptors: *Archaeology, *Excavations, *Dove Creek Canal, *Colorado, Surveys, History, Anasazi, Pueblo.

In 1985 13 of 24 prehistoric sites previously recorded by two surveys of Reach II of the Dove Creek Canal, which is a feature of the Dolores River reclamation project in southwestern Colorado, were investigated. The investigations were confined to the canal right-of-way and borrow areas and were designed to mitigate the impact of canal construction. Most of the sites were in plowed fields, thus blading was the major investigation method used on the project. No data were recovered from six sites, while four sites possibly have mixed artifacts and feature assemblages from Late Archaic (2000 B.C. to A.D. 500) processing camps and post-A.D. 600 Anasazi limited activity occupations. Three sites were small artifact scatters dating to the Basketmaker III or Pueblo I periods. A one-room field house and several exterior features were discovered at one site; tree-ring dates indicate the field house was constructed in A.D. 788 during the Pueblo I period. (Lantz-PTT)
W87-08205

HYDROLOGIC SITE SELECTION FOR MINING OF DEEP BASIN LIGNITE IN TEXAS,
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 4C.
W87-08222

DOLORES ARCHAEOLOGICAL PROGRAM: STUDIES IN ENVIRONMENTAL ARCHAEOLOGY,
Dolores Archaeological Program, CO.
K. L. Petersen, V. L. Clay, M. H. Matthews, and S. W. Neusius.
Bureau of Reclamation Engineering and Research Center, Denver, Colorado. August 1985. 277 p, 65 fig, 41 tab, 327 ref, 2 append. BuRec Contract 8-07-40-S0562.

Descriptors: *Archaeology, *Environmental effects, *Dolores River, *Colorado, Ecosystems, Field tests, Ecological effects.

This report presents some of the results of the Environmental Studies Group (1979-1981) and the Environmental Archaeology Group (1981-1983) of the Dolores Archaeological Program. The Dolores Archaeological Program is funded by the Bureau of Reclamation as part of the Dolores Project Cultural Resources Mitigation Program, which is responsible for the mitigation of impacts of the cultural resources to be affected by the construction of a multipurpose water storage and distribution system on the Dolores River in Montezuma County, southwestern Colorado. The chapters in this report summarize the basic data on the present environment of the project including climate, flora, fauna, and geology. They also evaluate the work accomplished by the Environmental Studies Group and report on the efforts to reconstruct the prehistoric environment at the time the Dolores Anasazi occupied the project area (ca. A.D. 600 to some time after A.D. 950). In addition, the results of literature searches and preliminary data on geology, and botanical and faunal remains recovered through archaeological excavation are presented and the final chapter gives some indication of the current direction of the Environmental Archaeology Group. The data in this report support the efforts of the Dolores Archaeological Program to both reconstruct and model the lifeways of the prehistoric inhabitants of the Dolores River valley and the adjacent uplands. (Author's abstract)
W87-08233

HIGHLAND LAKES: AN EVALUATION OF THE AVAILABLE BIOLOGICAL DATA,
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 2H.

W87-08237

CLASS III ARCHAEOLOGICAL SURVEY OF THE PHASE B CORRIDOR, TUCSON AQUEDUCT, CENTRAL ARIZONA PROJECT,
Arizona State Museum, Tucson. Cultural Resource Management Div.
C. E. Downum, A. G. Rankin, and J. S. Czaplicki.
Archaeological Series 168, February 1986. 248 p, 103 fig, 30 tab, 155 ref, append. Arizona Projects Office Contract No. 0-07-30-X0091.

Descriptors: *Archaeology, *Surveys, *Tucson aqueduct, *Arizona, Aqueducts, Hohokam, Water conveyance.

From February 1983 until November 1983 archaeologists conducted an intensive Class III survey, recording, and testing program for the Phase B segment of the Central Arizona Project Tucson Aqueduct. Located primarily in the Avra Valley about 12.5 km west of Tucson, the Phase B aqueduct runs for about 80 km from Marana on the north to the southeast corner of the San Xavier Papago Indian Reservation on the south. An area of 3,370 ha was intensively surveyed, and 47 sites and 8 nonsites were recorded. These include Archaic; Late Pioneer, Colonial, and Sedentary Hohokam; and Prohistoric 'Sobaipuri' sites. Site types include 4 Archaic camps; 2 Hohokam villages; 6 Hohokam farmstead-field houses; 28 limited-activity sites, many of which were attributed to the Hohokam; 4 quarries; and 3 Protohistoric sites. Of the 47 recorded sites, 24 are recommended for data recovery. (Author's abstract)
W87-08240

'THIS EVERLASTING SAND BED': CULTURAL RESOURCES INVESTIGATIONS AT THE TEXAS BIG SANDY PROJECT, WOOD AND UPSHUR COUNTIES, TEXAS,
Prewitt and Associates, Inc., Austin, TX.
T. K. Perttula, B. D. Skiles, M. B. Collins, M. C. Trachte, and F. Valdez.
Reports of Investigations, Number 52, May 1986. 590 p, 69 fig, 46 tab, 397 ref, 10 append.

Descriptors: *Archaeology, *History, *Texas, *Wood County, *Upshur County, *Surveys, Flood plains, Geological surveys.

Archaeological, historical, and geological investigations were conducted at the Texas Big Sandy Project, Wood and Upshur Counties, Texas, in September through November 1985. The project is funded by the Bureau of Reclamation, Southwest Region, and cosponsored by the Sabine River Authority of Texas and the Texas Water Development Board. These agencies are conducting a study of a possible reservoir which will flood about 4,800 acres on Big Sandy Creek. An intensive survey of 2,379 acres of the floodpool and project boundaries was carried out, followed by the testing of 12 sites by backhoe trench excavations for geoarcheological and archeological assessments. A total of 105 prehistoric and historic sites and 26 historic localities were recorded in the project area, including 63 prehistoric, 12 prehistoric/historic, and 56 historic in affiliation. There are seven high potential sites that are assessed as meeting the criteria for listing on the National Register of Historic Places. Further investigations are needed to assess the research potential at 52 prehistoric and 21 historic medium and unknown research potential sites. (Author's abstract)
W87-08242

PARAJE (DE FRA CRISTOBAL): INVESTIGATIONS OF A TERRITORIAL PERIOD HISPANIC VILLAGE SITE IN SOUTHERN NEW MEXICO,
Texas A and M Univ., College Station. Dept. of Anthropology.
D. K. Boyd.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB86-191764. Price codes: A19 in paper copy; and A01 in microfiche. Submitted to the Graduate College of Texas A and M University in Partial Fulfillment of the Requirements for the Degree of Master of Arts, May 1986. 422 p, 52 fig, 13 tab, 213 ref, 2 append.

Descriptors: *Paraje, *New Mexico, *Archaeology, *Elephant Butte Reservoir, Flood plains, History, Flood basins.

The historic village site of Paraje (de Fra Cristobal) lies on Federal land controlled by the U.S. Bureau of Reclamation, within the maximum flood pool of the Elephant Butte Reservoir, Rio Grande Project. Historical research and limited archaeological testing of the site (LA 1124) were recently conducted by the Bureau of Reclamation. Paraje was an important Territorial period village in southern New Mexico and has been nominated for the National Register of Historic Places. The recent investigations suggest that while Paraje was very dominantly Hispanic, the material culture from the site gives very little indication of this ethnic affiliation. (Author's abstract)
W87-08244

CULTURAL RESOURCE INVENTORY OF PORTIONS OF THE NEW ROCKFORD IRRIGATION AREAS AND THE SYKESTON CANAL ROUTE, GARRISON DIVERSION UNIT, CENTRAL NORTH DAKOTA,
Ethnoscience, Billings, MT.
K. Deaver, and B. A. Coutant.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB86-246873. Price codes: A06 in paper copy; and A01 in microfiche. January 1986. 105 p, 46 fig, 7 tab, 41 ref, append. BuRec Contract 3-CS-60-00260.

Descriptors: *North Dakota, *Garrison Diversion, *Archaeology, *Sykeston Canal, *Sheyenne River, *Surveys, Irrigation projects, Cairns, Environmental gradient.

A survey for prehistoric resources was conducted in six project areas associated with the Sykeston Canal and the New Rockford Irrigation Areas of the Garrison Diversion Unit. Only a portion of the Sykeston Canal route was surveyed. A 25% sample of the New Rockford Extension Irrigation Area was surveyed. Survey plots were selected on the basis of accessibility and an environmental stratification. Thirty-three sites were found, all located in two project areas. Site distribution showed a strong relationship to surface relief but no clear relationship to surface water. Site types in the Sykeston Canal area include tipi rings, cairns, and bison kills, and site density is very high along the bluffs of the Coteau Escarpment. Site types in the New Rockford Irrigation area include mounds and cultural material scatters, and site density is relatively high along the bluffs overlooking the Sheyenne River. (Author's abstract)
W87-08246

ARCHAEOLOGICAL EXCAVATION AT SITE 32SH110 AND 32WE107, SHERIDAN AND WELLS COUNTIES, NORTH DAKOTA.
Ethnoscience, Billings, MT.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB86-245511. Price codes: A09 in paper copy; and A01 in microfiche. February 1986. 79 p. BuRec Contract 3-CS-60-00260. Edited by Ken Deaver.

Descriptors: *Archaeology, *North Dakota, *Sheridan County, *Wells County, *Surveys, Environmental protection, Cairns, History.

Site testing was conducted and evaluated at 32SH110 and to mitigate potential impacts to site 32WE107. Both sites contain tipi rings and were excavated with circular units. Site 32SH110 contain two rings and eight cairns. One cairn and half of a ring were excavated. The cairn appears to have been a trash dump while the ring contained few artifacts, mostly flakes and bone fragments. Three ceramic sherds from the ring suggest contact with groups in Minnesota or Manitoba. The site is recommended as ineligible. Site 32WE107 contains at least five rings. The excavation sample included two and a quarter rings and a non-feature area. All excavated rings had interior hearths and rich artifact assemblages. The lithic indicate a predominance of small tool maintenance functions. The bone indicates intense bone processing for marrow and bone grease. Almost all bone is Bison and very few axial elements were brought to the site. Soil phosphates, phytoliths, and seeds point to other activities at the site. The site probably represents a single fall or winter occupation about 988 A.D. (Author's abstract)
W87-08247

CLASS III CULTURAL RESOURCES SURVEY OF THE GRAND VALLEY UNIT, STAGE TWO, MESA COUNTY, COLORADO,
Colorado State Univ., Fort Collins. Lab. of Public Archaeology.
M. A. Martorano, and L. Hyer.
Report of the Laboratory of Public Archaeology No. 63, May 1984. 126 p, 18 fig, 10 tab, 145 ref, 3 append.

Descriptors: *Grand Valley Unit, *Mesa County, *Colorado, *Archaeology, *Surveys, History, Canals, Irrigation districts, Irrigation ditches, Dams.

In March, April, May and June 1983, a Class III survey was conducted in the Grand Valley Unit, Stage Two, Mesa County, Colorado. Phase I of the project consisted of a literature search and completion of a research design. During Phase II, the field examination, a total of nine sites and ten isolated finds were newly recorded within the project area. In addition, three previously recorded sites were updated and two of these were evaluated for the National Register of Historic Places. The historic resources include the canal systems, a probable homestead, a recent foundation, a large trash dump, purple glass, a COKE bottle and glass insulators. The prehistoric resources consist of a Fremont-style petroglyph panel, two open campsites, and isolated flakes. Seven of the historic sites are canals, ditches or dams, part of the extensive irrigation system in the valley. The Government Highline Canal (5ME4676), the Orchard Mesa Canal (5ME4677), the Grand Valley Irrigation Company system (5ME4680), the upper Grant Valley Diversion Dam (5ME301), the Price Ditch (5ME4678) and the Stub Ditch (5ME4679) are recommended as eligible for nomination to the National Register as a theme group. Site 5ME4665, the lower Grand Valley Diversion Dam, is potentially eligible for inclusion in this theme group. Two additional sites, 5ME76, the petroglyph panel, and 5ME4672, the probable homestead, are determined to be potentially eligible for nomination to the National Register as individual sites. (Author's abstract)
W87-08249

CULTURAL RESOURCES ALONG A MAJOR TRAIL IN THE BIG MARIA MOUNTAINS, RIVERSIDE COUNTY, CALIFORNIA,
ASM Affiliates, Inc., San Diego, CA.
J. Schaefer.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB86-181716. Price codes: A07 in paper copy; and A01 in microfiche. March 14, 1985. 140 p, 14 fig, 4 tab, 61 ref, 2 append.

Descriptors: *Archaeology, *Big Maria Mountains, *Riverside, *Colorado River, *Surveys, *California, *Environmental effects, Quarries, Roads.

Well incised trail systems on the desert pavements and associated cultural resources leave a distinctive patterned record for the archaeologist to interpret, for the public to appreciate, and of modern Native Americans to trace their heritage. One such complex of cultural resources was documented on the eastern flanks of the Big Maria Mountains above the Colorado River. A total of seventeen sites were recorded during an intensive survey for a proposed rip-rap quarry and access road by the Bureau of Reclamation. Associated with a major trail system and two additional segments were 32 chipping stations, two lithic scatters, 22 cleared circles, a possible rock shelter, a rock alignment, and several trail-side cairns. This report describes these cultural resources in detail, including a dis-

cussion of the area's natural environment and cultural history. The significance of each site is discussed, with specific reference to scientific and Native American values and public status. The significance of the sites is also evaluated with reference to the famous Blythe Geoglyph (Intaglio) complex located only 1.4 m south, and to previous studies of trail-systems in the Big Maria Mountains. With additional consideration to site integrity, these signifance evaluations are used to assess eligibility for nomination to the National Register of Historic Places. Specific impact projections are made for each site, given known direct and indirect impacts from access road gradings and quarrying activities. Finally, alternative mitigation measures are recommended for minimizing the impacts to these cultural resources by the proposed project. (Lantz-PTT)
W87-08250

CULTURAL RESOURCE INVENTORY OF THE MILK-MISSOURI RIVER CANAL ROUTE, NORTHERN MONTANA,
Ethnoscience, Billings, MT.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB86-246881. Price codes: A07 in paper copy; and A01 in microfiche. March 1986. 125 p, 43 fig, 6 tab, 60 ref, append. Edited by Ken Deaver and Brad Coutant.

Descriptors: *Milk River, *Missouri River, *Montana, *Archaeology, *Surveys, Channels, History.

A cultural resource survey was conducted of the sixty-six mile route of the proposed Milk-Missouri River canal route. This route begins at the Missouri River and heads north across the uplands to the pre-glacial course of the Missouri River. It stays in this lowland setting and enters Big Sandy Creek. North of Laredo the creek and canal route follow a more recent and distinct channel with definite bluffs bordering the creek. Thirty-four sites were recorded along the route. They occur in all landforms but occur in the highest densities on the breaks landform overlooking the creek valleys. Tipi rings are particularly common in this setting. Seven of the sites are abandoned homesteads. All sites were evaluated for National Register eligibility. Four lowland cultural material sites with bone, FCR, lithics, and buried hearths were recommended as eligible. Thirteen additional sites had enough features or artifacts to suggest the possiblity of significant information and were recommended as potentially eligible. Recommendations are made for testing eligible and potentially eligible sites that cannot be avoided. (Author's abstract)
W87-08251

CULTURAL RESOURCES CLASS I SURVEY OF THE CENTRAL UTAH AREA: VOLUME 3, UTAH WATER DEVELOPMENT HISTORY RESEARCH UNIT,
MESA Corp., Orem, UT.
A. Avery, and D. Singer.
Available from the National Technical Information Service, Springfield, Virginia 22161, PB83-174540. Price codes: A04 in paper copy; and A01 in microfiche. 50 p, 1 fig, 48 ref. BuRec Contract 1-07-40-S1728.

Descriptors: *Archaeology, *Utah, *Environmental effects, *Water resources development, *Surveys, *Colorado River, *Literature searches, History, Canals, Dams, Hydroelectric plants.

A Class I cultural resources survey was completed for that portion of central Utah which will be affected by water development projects built by the Bureau of Reclamation. These projects are designed to divert and utilize Utah's portion of Colorado River water through a variety of dams, canals, pipelines, tunnels, and hydroelectric facilities. The purpose of this report was: (1) to conduct a literature search and compile a list of known archaeological and historical sites in tabular form with site location and a variety of other pertinent environmental and cultural data, and (2) to compile and map a complete list of previous cultural resource surveys in the project area. This information was organized into a form useful to Bureau of Reclamation cultural resource staff for their management of cultural resources. The resulting document, in six volumes, provides a series of research designs for the evaluation of site types, cultures, and historic sites which document agriculture, mining, water development, architecture, and settlement processes. The literature search provided information on 11,000 prehistoric and 4,500 historic sites. (Author's abstract)
W87-08252

ARCHAEOLOGICAL RESOURCES RECORDS REVIEW FOR THE UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION PROJECTS; FORT COBB, NORMAN, FOSS, ALTUS, MOUNTAIN PARK, AND ARBUCKLE, OKLAHOMA,
Oklahoma Archaeological Survey, Norman.
T. L. Steinacher, and R. L. Brooks.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB86-182995. Price codes: A09 in paper copy; and A01 in microfiche. September 1985. 185 p, 3 fig, 19 tab, 198 ref, 3 append.

Descriptors: *Archaeology, *Fort Cobb, *Norman, *Foss, *Altus, *Mountain Park, *Surveys, *Reviews, *Arbuckle, *Oklahoma, Reservoirs, Water resources development, History, Data collections.

A records review was conducted for archaeological resources within six Bureau of Reclamation reservoir projects in Oklahoma (Fort Cobb, Foss, Norman, Altus, Mountain Park, and Arbuckle). The review objectives included the identification of known archaeological resources, and exploration of potential documentary sources which could identify additional resources. A total of 144 officially recorded archaeological sites/isolated finds were identified for the six project areas. In addition, a number of potential site locations were also identified. (Author's abstract)
W87-08253

BATTLE OF THE BOG,
For primary bibliographic entry see Field 4C.
W87-08256

DESCRIPTION OF A LOTIC ENVIRONMENT (THE FRENCH UPPER RHONE) USING DISCRIMINANT ANALYSIS ON QUALITATIVE VARIABLES (APPROCHE PAR L'ANALYSE DISCRIMINANTE SUR VARIABLES QUALITATIVES D'UN MILIEU LOTIQUE, LE HAUT RHONE FRANCAIS),
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Ecologie.
H. Persat, A. Nelva, and D. Chessel.
Acta Oecologica, Oecologia Generalum, Vol. 6, No. 4, p 365-381, 1985. 7 fig, 24 ref, append.

Descriptors: *Limnology, *Ecological effects, *Statistical methods, *Lotic environment, *Fish habitats, Fish populations, Discriminant analysis, Sampling, Rhone River, Impoundments, Urbanization, Industrial development, Mathematical analysis.

Distributed among 189 fishing efforts and 44 stations, 4,078 sampling spots have been used for spot-recording the fish habitat in the Upper Rhone River, France. The stations are all associated with one of three large hydroelectric impoundments: Chautagne, Belley, and Brenier-Cordon. A station pattern is described by means of discriminant analysis on qualitative variables. The impact of past and present human activities, the changes in discharge and their interactions determine the characteristics and the evolution of the biotope. These observations make it possible to define a general method to approach complex environments by spot sampling. The method, applied parallel to samplings of flora and fauna, allows precise establishment of the relationships between species and habitats. (Airone-PTT)
W87-08283

EVALUATION OF WATER QUALITY IMPACTS FROM WATER RESOURCES MANAGEMENT PROGRAMS AND PROJECTS,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
For primary bibliographic entry see Field 5G.
W87-08366

ENVIRONMENTAL AND WATER QUALITY OPERATIONAL STUDIES (EWQOS) - STATUS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5G.
W87-08368

RIVER AND RESERVOIR SYSTEMS WATER QUALITY MODELING CAPABILITY,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 5G.
W87-08376

WATER CONTROL AND ENVIRONMENTAL OBJECTIVES,
Army Engineer Div. Ohio River, Cincinnati.
M. Anthony.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 128-134, append.

Descriptors: *Water resources development, *Water management, *Resources management, Water quality control, Aquatic environment, Reservoirs, Multipurpose reservoirs, Reservoir operation, Environmental effects.

Multiple environmental impacts caused by reservoir and reservoir system regulation strategies are discussed. Impacts that range from subtle to dramatic, vary from short-range to long-range in both space and time, and may be positive or negative, are cited. Effects that concern all habitats and reservoir and downstream water uses are discussed. The image of the Corps of Engineers, in light of the impacts caused by the reservoir system, is considered. It is argued that the Corps' image and the effectiveness of its activities would be enhanced if the public understood that water control is far more compatible with environmental concerns than is popularly believed. A detailed outline of the Ohio River Division Water Control Objectives and Actions plan is presented. (See also W87-08365) (Halterman-PTT)
W87-08380

UPDATE ON DREDGING ACTIVITIES IN THE PACIFIC NORTHWEST,
Army Engineer Div. North Pacific, Portland, OR.
R. J. Hopman.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 135-142, 7 ref.

Descriptors: *Water resources development, *Water management, *Environmental effects, Ocean dumping, Ecosystems, Water sampling, Water quality, Water use, Volcanoes, Dredging, Jetties.

A brief update of some of the major dredging-related activities of the Corps of Engineers in the Pacific Northwest is provided. Four specific items are briefly discussed - Mt. St. Helens, jetties, dredging plant and special studies. A brief history of the Mt. St. Helens eruption is presented, with a discussion of subsequent water quality impacts, fisheries impacts, and the development of seeding program. A jetty system built along the Umpqua River, Oregon, is described and the projected changes in water quality resulting from the system are outlined. The specifications of a recently acquired hopper dredge are presented, and some of the potential work projected for it is discussed. Finally, the objectives of a three-year study on ocean dumping are outlined. (See also W87-08365) (Halterman-PTT)
W87-08381

EXPERIENCE OF THE ST. PAUL DISTRICT, CORPS OF ENGINEERS, WITH STATE CO-ORDINATION OF DREDGING ACTIVITIES,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 5G.
W87-08382

DISPOSAL OF HIGHLY CONTAMINATED DREDGE MATERIAL,
Army Engineer Div. North Atlantic, New York.
For primary bibliographic entry see Field 5G.
W87-08383

OCEAN DUMPING OF DREDGED MATERIAL OFF THE LOUISIANA COAST,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 5G.
W87-08384

FREMONT HABITATION SITES: A PREDICTIVE MODEL OF SITE LOCATION FOR THE IRRIGATION AND DRAINAGE SYSTEM, BONNEVILLE UNIT, CENTRAL UTAH PROJECT,
P-III Associates, Inc., Salt Lake City, UT.
A. R. Schroedl.
Cultural Resources Report 415-1-8606, September 1986. 81 p, 5 fig, 8 tab, 23 ref, 5 append.

Descriptors: *Model studies, *Irrigation design, *Irrigation engineering, *Irrigation programs, *Archeology, Irrigation, Central Utah Project, Utah, Model testing.

A summary of a predictive model of habitation site locations based on existing site locational data is presented. The model was developed for the Irrigation and Drainage System of the Bonneville Unit of the Central Utah Project, a large water project intended to develop water resources for private and commercial use, in order to assist in fulfilling their legal obligation to protect and preserve cultural resources that might be affected by the Central Utah Project. An abundance of prehistoric cultural resources in central Utah, including the Fremont habition sites where multiple activities took place and which were occupied for long enough to allow the accumulation of extensive cultural deposits, were identified. Advance knowledge of possible habitation site locations would be useful in designing engineering alternatives to preserve the sites. Selected locations within high probability areas were field tested to assess the validity of the model. Final recommendations concerning the likelihood of encountering sites in the project areas based on model development were made. (Wood-PTT)
W87-08496

IMPACT INTERACTION POTENTIAL: A BASIN-WIDE ALGORITHM FOR ASSESSING CUMULATIVE IMPACTS FROM HYDROPOWER PROJECTS,
Envirosphere Co., Bellevue, WA.
R. E. Emery.
Journal of Environmental Management JEVMAW, Vol. 23, No. 4, p 341-360, December 1986. 3 fig, 7 tab, 13 ref, append.

Descriptors: *Algorithms, *Model studies, *Computer programs, *Project planning, *Environmental effects, *Hydroelectric plants, River basins, Resources management, Regulation.

The U.S. Federal Energy Regulatory Commission has proposed a 'Cluster Impact Assessment Procedure' (CIAP) for analyzing cumulative impacts from hydropower projects on the resources of a river basin. While the CIAP is based on analyses of perceived magnitudes of impacts, it avoids any interpretation of the potential for basin-wide interaction among the projects leading to an accumulation of their effects in the resources. A measure of an 'impact interaction potential' (IIP) is suggested here to describe the functional side of cumulative impacts. This tendency of a project cluster to cause cumulative impacts (its 'cumulativity') is examined through subbasin disaggregations of projects and resources. A dispersion of the project's impacts across subbasins is evaluated using linear algebra and principles of information theory. The formalized algorithm is programmed in BASIC and proposed as an IIP Assessment Loop in the CIAP (the BASIC program is here included as an appendix). The IIP Loop attaches to the Multiple Project Assessment Phase as a causal interpretation of cumulative impacts, complementary to the effects analyzed via the CIAP's use of weighted situations. Use of the algorithm is demonstrated with a hypothetical project cluster in the Salmon River Basin (Idaho). (Author's abstract)
W87-08537

7. RESOURCES DATA

7A. Network Design

GAUGING FREQUENCY AND DETECTION OF RATING CHANGES,
Ministry of Works and Development, Christchurch (New Zealand). Hydrology Centre.
For primary bibliographic entry see Field 2E.
W87-07617

LAND: RESOURCE BASE AND INVENTORY,
Soil Conservation Service, Washington, DC.
K. W. Flach, C. Johannsen, R. W. Arnold, K. W. Bauer, and M. F. Brewer.
IN: Soil and Water Resources: Research Priorities for the Nation, Soil Science Society of America, Inc., Madison, Wisconsin, 1981. p 21-40, 1 tab, 12 ref.

Descriptors: *Soil properties, *Research priorities, *Networks, *Land use, *Data acquisition, *Soil erosion, Soil management, Range management, Pasture management, Data collections, Soil moisture retention, Model studies, Soil water, Soil organic matter, Crop production, Soil conservation, Soil stability.

Some background information on the land resources of the United States are reviewed and areas where research is needed in this field are identified. The acreage of cropland and forest land is decreasing while the acreage of pastureland, native pasture, rangeland, and urban land is increasing. The Corn Belt, Lake States, Northern Plains, and Delta States have the largest acreages of soils well suited for agriculture. Moisture supplies tend to be less in soils west of the Mississippi. Soil temperatures are of a mesic regime in the central part of the United States. Better methods are needed to characterize soil quality. Soil erosion by water is measured primarily by the Universal Soil Loss Equation. The wind erosion equation estimates the susceptibility of soil to wind erosion. Networks are needed for erosion measurement in all major management and land use conditions in the country. Information is needed on the effects of soil erosion on soil productivity to justify the use of private and public funds for soil conservation and for establishing objective standards of tolerable soil loss. Data is needed on the water holding capacity, tilth, and nutrient content of soils to assess the suitability of soils for crop production. A basic strategy for collecting information and an integrated system to handle research data on soils must be developed. Other research priorities are the development of models to predict the effects of global forces on United States agriculture and the assemblage and maintenance of integrated land information systems for all parts of the United States. (See also W87-07680) (Geiger-PTT)
W87-07682

USE OF MARINE ELECTROMAGNETIC CONDUCTIVITY AS A TOOL IN HYDROGEOLOGIC INVESTIGATIONS,
Geological Survey, Trenton, NJ.
P. B. Duran.
Ground Water GRWAAP, Vol. 25, No. 2, p 160-166, March-April 1987. 8 fig, 23 ref.

Descriptors: *Geophysics, *Electrical studies, *Seismic studies, *Channel morphology, *Channels, *Data acquisition, *Conductivity, *Electromagnetic conductivity, Delaware River, Rivers, Pennsylvania, New Jersey, Data interpretation, Seismic properties, Sand, Bedrock, Clays, Silt.

Field procedures for collecting marine electromagnetic (EM) conductivity data were developed by the U.S. Geological Survey as part of a hydrogeologic investigation of the Delaware River shipping channel. Eighty miles of marine EM data collected along the border of Pennsylvania and New Jersey were used to help interpret results from high-resolution, continuous seismic-reflection surveys done in the summer of 1984. Comparison of EM data with lithologic logs from river borings showed a direct relationship. EM conductivity of sand or bedrock ranged from 4 to 10 millimhos per meter (mmhos/m). Extensive clay beneath the shipping channel generally gave readings exceeding 20 mmhos/m. Conductivity readings over silts were almost always between these values (11 to 20 mmhos/m). This relation was used to help interpret the continuous seismic-reflection data. (Author's abstract)
W87-07850

STATISTICAL CHARACTERISTICS OF GROUND-WATER QUALITY VARIABLES,
Woodward-Clyde Consultants, Denver, CO.
R. H. Montgomery, J. C. Loftis, and J. Harris.
Ground Water GRWAAP, Vol. 25, No. 2, p 176-184, March-April 1987. 3 fig, 4 tab, 17 ref. DOI Grant 14-08-0001-1060.

Descriptors: *Monitoring, *Statistics, *Water quality data, *Data collections, *Network design, *Groundwater, *Groundwater management, *Statistical analysis, *Groundwater pollution, Quality control, Mathematical studies, Seasonal variation, Time series analysis, Distribution graphs, Water pollution control, Monitoring, Water management.

The emerging problem of contamination of groundwater resources has created a need for information which can be supplied by properly designed groundwater quality monitoring programs. The effective design of monitoring programs and the subsequent utilization of data obtained depends on an understanding of the general statistical characteristics of groundwater quality variables. In order to provide some backround information on these characteristics, a synthesis of current literature and a statistical analysis of existing groundwater quality data were conducted. Specifically, the purpose of the study was to determine whether groundwater quality variables: (1) are normally distributed, (2) exhibit seasonal patterns, and (3) are correlated in time. The results of the investigation suggest that many groundwater quality variables: are not normally distributed, but have skewed right distributions; can exhibit seasonal fluctuations, of various shapes and magnitudes, especially in shallow or highly permeable aquifers; and can exhibit significant serial correlation when samples are collected quarterly. (See also W87-07853) (Author's abstract)
W87-07852

ICA - INFORMATION SYSTEMS - WHERE NEXT,
Bristol Waterworks Co. (England).
S. P. Jaggard.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 41, No. 1, p 31-39, February 1987. 8 ref.

Descriptors: *Data collection, *Water supply, *Design criteria, *Engineering, Computers, Monitoring, Management.

The monitoring undertaken by ICA and telemetry systems provides hitherto unavailable knowledge of the performance and behavior of the operational resources of the Water Industry. The use of this knowledge to contribute to the design of new works and the refurbishment and management of existing installations is discussed in the context of improved responsiveness to the uncertain demands of the future and the need for high cost-effectiveness. Suggestions are offered outlining the impact of computing technology on water engineering as the comprehensive monitoring and control of vital parameters improves and becomes more extensive, reliable and usable. (Author's abstract)

W87-08087

GROUNDWATER SAMPLING DURING ARTIFICIAL RECHARGE: EQUIPMENT, TECHNIQUES, AND DATA ANALYSES,
Geological Survey, Lawrence, KS. Water Resources Div.
D. C. Signor.
IN: Artificial Recharge of Groundwater, Butterworth Publishers, Boston, Massachusetts. 1985. p 151-202, 36 fig, 3 tab, 54 ref.

Descriptors: *Sampling, *Groundwater management, *Artificial recharge, *Data interpretation, *Groundwater recharge, *Sampling, *Observation wells, Tracers, Data collections, Spatial distribution, Temporal distribution, Groundwater quality.

Because installation of monitoring devices is expensive and time-consuming, the objectives of sampling must be carefully considered and sampling procedures developed before recharge commences. It is important to place sampling points so as to obtain an areal and vertical distribution of data that provides a valid basis for determining or analyzing the flow regime, quality effects, and areal distributions of the recharged water. Five phases necessary to optimize a monitoring network are: (1) preliminary network design and information gathering, (2) initial installation and testing, (3) completion and verification, (4) operation, and (5) project termination or continuation. Observation wells usually are of small diameter and pumping them is difficult; however, numerous small-diameter pumping devices have been developed. A simple inexpensive means of sampling from wells is a hand-operated thief sampler but the sample may not be representative. A gas-driven piston pump was developed to meet requirements for use in small-diameter wells. Three syringe-type sampling devices were developed to preserve particular water quality parameters. The syringe operates by the action of pressure both above and below atmospheric on the syringe plunger. In situations in which the water level in a monitor well is sufficiently close to the land surface, samples can be drawn directly from the well by suction using centrifugal pumps, diaphragm pumps, and peristaltic pumps. Porosity of an aquifer can be calculated with data from a two-well test, which determines the volume of water pumped from one well to effect the breakthrough of a tracer from an unpumped well. A tracing technique is reported for determining average porosity and the different permeabilities of a multilayered, horizontally stratified aquifer. Artificial recharge research at three sites is briefly reviewed to indicate the utility of monitoring equipment and sampling techniques and how the data were analyzed. (See also W87-08137) (Lantz-PTT)
W87-08143

RIVER WATER QUALITY MONITORING,
Oklahoma Univ., Norman. Environmental and Ground Water Inst.
L. W. Canter.
Lewis Publishers, Chelsea, MI. 1985. 170 p.

Descriptors: *Water quality, *Data collections, *Sampling, *Rivers, *Monitoring, *Water pollution control, Water sampling, Water analysis, Water quality control.

River water quality monitoring is often required for establishing baseline conditions, setting quality criteria and standards, monitoring temporal changes, and determining the impacts of specific projects and developments. Careful planning and implementation of water quality studies is necessary in optimizing the gathered information relative to study expenditures. As greater attention is directed toward river water quality both in the United States and throughout the developed and developing world, it is anticipated that the needs for planning and conducting of monitoring programs will increase. The purpose of this book is to present practical information on the planning and conduction of river water quality monitoring studies. Chapter 1 presents some brief information on water pollution and quality, and summarizes typical limitations of water quality study plans. Chapter 2 presents an overview of principles for planning and conducting water quality studies, including the delineation of study objecives. Chapter 3 describes preliminary field work needed for a study, including general field reconnaissance and the assemblage of information on water uses, wastewater sources, and flow balances. Detailed information on the rationale for selecting hydraulic, water quality, and biological parameters is presented in Chapter 4. Chapter 5 addresses the factors for consideration in locating sampling stations and determining the appropriate frequency of sampling. Sampling equipment, sample collection, and planning for laboratory analyses are covered in Chapter 6. Finally, Chapter 7 contains information on data analysis and presentation, including the preparation of reports on water quality studies. Detailed technical information and annotated bibliographies are contained in ten appendices. (Lantz-PTT)
W87-08165

MONITORING OF SOLID WASTE DISPOSAL SITES: WHAT FACTORS ARE RELEVANT FOR ELECTRIC UTILITIES,
Little (Arthur D.), Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W87-08188

MONITORING EXPERIENCES AT A FLUE GAS DESULFURIZATION SLUDGE DISPOSAL SITE: WHAT CAN BE ACHIEVED,
Baker (Michael), Jr., Inc., Beaver, PA.
For primary bibliographic entry see Field 5B.
W87-08189

ROLE OF RESEARCH MEASUREMENT NETWORKS AS CONTRIBUTORS TO FEDERAL ASSESSMENTS OF ACID DEPOSITION,
Battelle Pacific Northwest Labs., Richland, WA.
J. M. Hales, B. B. Hicks, and J. M. Miller.
Bulletin of the American Meteorological Society BAMIAT, Vol. 68, No. 3, p 216-225, March 1987. 5 fig, 3 tab, 34 ref.

Descriptors: *Research networks, *Acid deposition, *Acid rain, Measurement, Deposition, Model studies, Networks, Spatial variation, Distribution.

Three demands for wet-deposition data and dry-deposition data are particularly important at the present time: (1) the analysis of long-term trends to evaluate the consequences of emission changes, (2) the measurement of deposition loadings to determine impacts to receptors, and (3) model development and the analysis of atmospheric source-receptor phenomena. The diversity of these demands has led to deployment of a variety of networks to satisfy different measurement requirements. Consideration of this diversity of network goals has led to a distinction between research-oriented networks and routine measurement networks. Research-oriented networks generally contain a comparatively small number of stations, and make relatively intensive measurements with fine time resolution, to focus on relevant processes. These networks use relatively advanced measurement techniques and require much-greater scientific attention than routine measurement networks. Routine networks usually have a greater number of simpler stations to provide finer spatial resolution, but have a coarser time resolution; they yield a more-descriptive picture of wet and dry deposition over periods of weeks or months. Both types of networks have their place in the overall measurement effort. The relationship between existing research arrays and routine-measurement arrays is discussed, and a rationale is suggested for operation of the research arrays - the Multistate Power Production Pollution Study (MAP3S) (for wet deposition) and COre Research Establishment (CORE) (for dry deposition) research measurement networks. (Author's abstract)
W87-08314

WATER QUALITY LABORATORY ANALYSIS,
Corps of Engineers, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5A.

W87-08370

7B. Data Acquisition

INVESTIGATION OF A CHEMILUMINESCENT SYSTEM FOR THE DETERMINATION OF AMMONIA BY FLOW-INJECTION ANALYSIS,
Michigan State Univ., East Lansing. Dept. of Chemistry.
P. R. Kraus, and S. R. Crouch.
Analytical Letters ANALBP, Vol. 20, No. 2, p 183-200, February 1987. 6 fig, 2 tab, 25 ref. NSF Grant CHE 83-20620.

Descriptors: *Analytical methods, *Ammonia, *Chemiluminescence, *Flow-injection analysis, Automation, Dialysis, Membrane processes, Hypochlorites, Luminol, Sample preparation.

A novel system for the determination of ammonia based on the chemiluminescent reaction between hypochlorite and luminol is presented. The technique of flow injection analysis was employed to automate the system. Ammonia reacts with hypochlorite to form monochloramine in basic solution which decreases the observed chemiluminescence intensity. Several interferents are identified, and the reasons why they interfere are discussed. The effects of interferents are minimized through the use of a double-tube dialyzer where the ammonia is diffused across the dialyzer membrane into a recipient stream of hydrochloric acid. The method was used to analyze river water with added ammonia. (Author's abstract)
W87-07619

SPECIATION OF MANGANESE IN FRESH WATER - I: USE OF EPR STUDIES,
Queensland Univ., Brisbane (Australia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W87-07625

MONITORING LEAD EXPOSURE OF FISH,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W87-07639

DEVELOPMENT AND EVALUATION OF CLOUD WATER COLLECTIONS,
Nevada Univ. System, Reno. Atmospheric Sciences Center.
U. Katz, and D. F. Miller.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-232529. Price codes: A06 in paper copy, A01 in microfiche. Final Report, April 1984. 102 p., 16 fig, 9 tab, 17 ref, append.

Descriptors: *Sampling, *Samples, *Clouds, *Measuring instruments, *Water collectors, *Chemical analysis, *Pollutant identification, Water sampling, Ions, Performance evaluation, Mathematical analysis, Nitrates, Sulfates.

Two varieties of impactor-type samplers were designed and constructed to specifically collect cloud water samples for chemical characterization. Design features included a sharp drop-size cut-off, high collection efficiency, minimal contact area and protection against contamination and evaporation. After preliminary testing, the more accomplished cloud water collector was deployed to Whiteface Mountain, NY to participate in the Summer-1982 Study conducted by the Atmospheric Sciences Research Center (ASRC) of the State University of New York at Albany. The DRI and ASRC collectors were chemically analyzed by ASRC at an adjacent laboratory on the Mountain. Eleven cloud events covering a period of 140 hours between June 29 and August 9 were sampled by both groups of investigators. Because sampling intervals did not coincide, the chemical composition of cloud samples from the two collectors was compared using time-weighted averages computed for 30-minute intervals. For the major ionic species

of cloud water (H(+), NH4(+), NO3(-), SO4(2-)), the agreement between samples from the two types of collectors was considered good; linear correlation coefficients (r) were > 0.80. Better agreement would be expected if coincident samples had been available for more direct comparisons. For the minor ionic species (Na(+), K(+), Cl(-)), the correlations between samples were relatively poor (r < 0.6). Although pH had a correlation of 0.92, the slope and intercept of the regression line were different than those of an equivalence line (unity slope and zero intercept). The slope of the regression line for nitrate was 1.3 with the ASRC samples showing higher nitrate concentrations than the DRI samples. With regard to ammonium and sulfate, the slope and intercept of the regression lines were similar to the equivalence values. (Author's abstract)
W87-07653

PAKISTAN CASE STUDY: WATER SUPPLY,
Pakistan Water and Power Development Authority, Lahore.
R. N. Tarar.
IN: Techniques for Prediction of Runoff from Glacierized Areas, IAHS Publication No. 149, 1985. p 109-113, 1 fig, 1 tab, 2 ref.

Descriptors: *Mathematical equations, *Remote sensing, *Glaciers, *Pakistan, *Satellite technology, *Runoff forecasting, Hydrologic data collections, Snow cover, Snowmelt, Precipitation, Rainfall-runoff relationships, Flood forecasting, Snowpack, Water supply, Flow discharge, Streamflow, Regression analysis.

In Pakistan, there is a need for forecasts of total water availability for the summer period for hydropower and irrigation. The potential for using satellite imagery to relate snow cover to seasonal runoff was examined for the four-year period 1975-1978 in 13 basins. The method assumes that the areal extent of the spring snowpack will be directly related to the total quantity of summer runoff. The snow covered area on April 1 was linked to total measured runoff for the basin from April to August 31 with a linear regression equation. Analysis of results for 5 of the 13 basins shows a strong and positive relationship with summer discharge in the non-glacierized basin, while the relationship is strongly negative in the highly glacierized basins. The method is not yet operational because imagery cannot be produced quickly enough for the forecasts to be of great use. The image coverage, and thus the interpretation, is limited by cloud cover. Refinement of the method, using imagery from new satellites and faster data transmission, offers considerable hope for the future. (See also W87-07708) (Geiger-PTT)
W87-07716

ACOUSTIC STUDY OF DREDGED-MATERIAL DUMPING IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W87-07744

CONTINUOUS-FLOW REAL-TIME AND FLOW INJECTION DETERMINATION OF RAINWATER PH WITH A POLY(VINYL CHLORIDE)-BASED TUBULAR MEMBRANE ELECTRODE,
University of Central Florida, Orlando. Dept. of Chemistry.
B. C. Madsen, and D. W. Doller.
Analytical Chemistry ANCHAM, Vol. 59, No. 1, p 127-130, January 1987. 2 fig, 2 tab, 24 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Acid rain, *Precipitation, *Water analysis, *Flow injection analysis, *Hydrogen ion concentration, *Electrodes, Chemical analysis.

The measurement of rainwater pH and acidity is subject to many sources of error. Utilization of a tubular flow-through electrode which include a pH-sensing membrane when incorporated into a continuous flow or flow injecti analysis system can provide a viable approach to near-real-time rainwater pH measurement with minimal sample requirements. A continuous-flow method that utilizes a poly(vinyl chloride)-based tubular membrane electrode was used to determine the pH of rainwater in real time. A flow injection method based on the same tubular membrane electrode was applied to measurement of individual sample pH. Results agree favorably when compared with measurements made with a commercial combination electrode. Prominent features include linear calibration curves from pH 2.7 to 5.0 and a sampling rate of 60/h for the flow injection method. (Authors' abstract)
W87-07824

AUTOMATED APPROACH FOR AMMONIA AND TKN ANALYSIS IN WASTEWATER,
W. H. Hall, and C. B. Dones.
American Laboratory ALBYBL, Vol. 18, No. 2, p 78-81, December 1986. 6 tab, 2 ref.

Descriptors: *Wastewater treatment, *Measuring instruments, *Automation, *Chemical analysis, *Water analysis, *Ammonia, *Nitrogen, *Nitrogen compounds.

An automatic analyzer has increased the number of samples the Seneca Wastewater Treatment Plant laboratory is able to analyze in a normal work day, thus improving the laboratory's ability to monitor the process of the wastewater plant. The ability to analyze unusual samples without a major interruption in the laboratory schedule is of great benefit to the laboratory and the plant. The long wait usually associated with ammonia analyses is no longer a consideration. Ammonia and total Kjeldahl nitrogen (TKN) analyses that yield unusual results can easily be repeated to verify the accuracy of the results. The use of photocells which determine the end point of the analysis account for the excellent precision and accuracy achieved by the instrument. One of the benefits of the system is the capability of minimizing human error while allowing human input. As long as the analyst uses good quality control procedures and establishes a regular maintenance program, the analyzer produces results that are both fast and reliable for TKN and ammonia analyses in water and wastewater. (Authors' abstract)
W87-07833

USE OF MARINE ELECTROMAGNETIC CONDUCTIVITY AS A TOOL IN HYDROGEOLOGIC INVESTIGATIONS,
Geological Survey, Trenton, NJ.
For primary bibliographic entry see Field 7A.
W87-07850

STATISTICAL CHARACTERISTICS OF GROUND-WATER QUALITY VARIABLES,
Woodward-Clyde Consultants, Denver, CO.
For primary bibliographic entry see Field 7A.
W87-07852

EFFECT OF AMBIENT OXYGEN CONCENTRATION ON MEASUREMENTS OF SEDIMENT OXYGEN CONSUMPTION,
McGill Univ., Montreal (Quebec). Dept. of Biology.
P. J. Campbell, and F. H. Rigler.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 7, p 1340-1349, July 1986. 11 fig, 4 tab, 32 ref.

Descriptors: *Limnology, *Water analysis, *Sampling, *Oxygen requirements, *Oxygen depletion, *Lake sediments, *Chemical properties, *Hypolimnion, Lakes, Quebec, Oxygen balance, Oxygen uptake, Stratification.

The disparity between hypolimnetic oxygen depletion in situ (HOD; independent of the ambient oxygen concentration), used to calculate sediment oxygen consumption (SOC) in one lake in southern Quebec, and measurements of SOC (dependent on the oxygen concentration) were found to be minimal when experimental factors were controlled. Using gas-tight methods, SOC at 7-5 mg/l decreased by 75% when the oxygen concentration in respirometers fell to 3-1 mg/l. With continuous mixing, the comparable decrease in SOC was 50%. Finally, the decrease was less than 30% and obvious only below 2 mg/l when the oxygen concentration was held constant in continuous flow respirometers. SOC results using the last procedure were within 10% of the mean SOC calculated indirectly from hypolimnetic oxygen budgets for the two previous years. Thus, mixing and a constant or slowly changing ambient oxygen concentration are required for realistic SOC measurements. In another experiment, oxygen uptake in water overlying the sediment accounted for a large and variable portion of the SOC, often more than 50%. It is concluded that it may be impossible to separate the influence of the water and sediment on the HOD. (Author's abstract)
W87-07872

COMPARISON OF METHODS FOR DETERMINING SATURATED HYDRAULIC CONDUCTIVITY AND DRAINABLE POROSITY OF TWO SOUTHERN ALBERTA SOILS,
Department of Agriculture, Lethbridge (Alberta). Drainage Branch.
For primary bibliographic entry see Field 2G.
W87-07910

RAPID METHOD FOR ESTIMATING WEIGHTED SOIL SALINITY FROM APPARENT SOIL ELECTRICAL CONDUCTIVITY MEASURED WITH AN ABOVEGROUND ELECTROMAGNETIC INDUCTION METER,
Missouri Univ.-Columbia. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W87-07912

COLOR ENHANCES ACCURACY OF CONTINUOUS WASTEWATER ANALYSES,
T. Elliott.
Power POWEAD, Vol. 130, No. 12, p 51-54, December 1986. 2 fig, 2 tab.

Descriptors: *Wastewater analysis, *Monitoring, *Colorimetry, *Measuring instruments, *Benefits, *Automation, Chemical analysis, Wastewater management, Maintenance, Cost-benefit analysis, Performance evaluation.

An on-line colorimeter designed for continuous wastewater analysis is described. The system features single-beam/dual-wavelength capability, providing a correction for any changes in light-source or sample-cell conditions. It can also compensate for moderate changes in sample turbidity and color by proper selection of the reference wavelength. The electronic system for the pump/calorimeter includes a log-ratio converter. Solid-state electronics provide system reliability and stability. Chemistries for the pump/calorimeter analyzer permit direct readout of concentrations in mg/l. Special features include systems for measuring phosphate and chlorine in effluents. The analyzer's optical/electronics combination allows the introduction of some chemistries that would be impossible with a single-wavelength instrument, including methods for detecting chelant residuals and chlorine dioxide. Overall, the system features reliability, minimum maintenance, and cost-effectiveness. (Doria-PTT)
W87-07923

ANALYSIS OF SPATIAL INHOMOGENEITIES IN CUMULUS CLOUDS USING HIGH SPATIAL RESOLUTION LANDSAT DATA,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
L. Parker, R. M. Welch, and D. J. Musil.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 10, p 1301-1314, October 1986. 8 fig, 2 tab, 32 ref. NSF Grant ATM-82-15332, NASA, Grant NAG-1-542.

Descriptors: *Clouds, *Atmospheric physics, *Satellite technology, *Remote sensing, *Radiation, *Climatology, *Meteorological data collection, Aircraft, Energy, Model testing, Entrainment, Data interpretation, Statistical analysis, Data collections.

A knowledge of typical sizes and locations of cloud inhomogeneities as a function of cloud size may provide a better understanding of cloud dynamics, especially those processes associated with entrainment. Aircraft observations and high resolution Landsat Multispectral Scanner digital data were used to determine the sizes of spatial inhomogeneities ('holes') in cumulus clouds. The majority of holes are found near cloud edges, but the larger holes tend to be found in cloud interiors. Aircraft measurements show these cloud spatial inhomogeneities in the range of 100 to 500 m, while Landsat data show them in the range of 100 m to 3 km. The number of holes per cloud decreases exponentially with increasing hole diameter. Small clouds not only have smaller holes, but also fewer holes than large clouds. Large clouds have large holes in them, as well as large numbers of the smaller holes. The total cloud area occupied by holes increases with increasing cloud size. (Author's abstract)
W87-07930

RAINFALL OVER OCEANS INFERRED FROM NIMBUS 7 SMMR: APPLICATION TO 1982-83 EL NINO,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2B.
W87-07935

REMOTE SENSING OF HAIL WITH A DUAL LINEAR POLARIZATION RADAR,
Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
K. Aydin, T. A. Seliga, and V. Balaji.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 10, p 1475-1484, October 1986. 6 fig, 1 tab, 52 ref. NSF Grant ATM-8003376, University Corporation for Atmospheric Research Subcontract NCAR S3025.

Descriptors: *Measuring instruments, *Remote sensing, *Hail, *Radar, *Weather, Technology, Mathematical studies, Standard deviation, Precipitation, Convective precipitation, Storms, Meteorological data collection, Data collections.

The remote sensing of hail by a dual linear polarization (differential reflectivity) radar was demonstrated by using a new hail signal H sub DR, derived from differences in the radar reflectivities of rain and hail at horizontal and vertical linear polarizations. Disdrometer measurements of raindrop size distributions and model gamma distributions fell within a well-defined region of the Z sub H - Z sub DR plane. The (Z sub H, Z sub DR) pairs lying above the boundary of the rainfall region were considered to represent hail and were used as the basis for defining H sub DR. H sub DR contours in two major hail storms in Colorado exhibited strong gradients at the edges of the hail regions and a wide dynamic range. In situ observations of hail by mobile chase teams and comparison with Storm Data reports all gave positive confirmation of H sub DR as a hail signal. On the other hand, 55 dBZ reflectivity factor threshold levels were also generally indicative of hail regions based on ground confirmations, although the 55 dBZ reflectivity factor threshold did not always agree with H sub DR. Although this study and others under way are highly supportive of the H sub DR hail detection technique, many more studies are required to gain statistical confidence in its interpretations. (Doria-PTT)
W87-07936

DETERMINATION OF PHOTOSYNTHETIC PIGMENT COMPOSITION IN AN INDIVIDUAL PHYTOPLANKTON CELL IN SEAS AND LAKES USING FLUORESCENCE MICROSCOPY; PROPERTIES OF THE FLUORESCENCE EMITTED FROM PICOPHYTOPLANKTON CELLS,
Mitsubishi-Kasei Inst. of Life Sciences, Tokyo (Japan).
T. Tsuji, K. Ohki, and Y. Fujita.
Marine Biology MBIOAJ, Vol. 93, No. 3, p 343-349, December 1986. 5 fig, 4 tab, 15 ref. NIBB Grant 84-132, 85-132 and Japan Society for the Promotion of Science Grant IPS-MBR008/R-XMB-0566/83-18664.

Descriptors: *Measuring instruments, *Limnology, *Pigments, *Phytoplankton, *Species composition, *Marine environment, *Aquatic environment, *Chemical composition, *Fluorescence microscopy, Environment, Ecosystems, Chemical analysis, Diatoms, Cyanophyta, Algae, Chlorophyll a, Photosynthesis, Aquatic plants, Plankton.

The fluorescence spectra of intact cells of cultured phytoplankton were studied to develop a method for determining photosynthetic pigment species in individual cells. Spectra were measured for cell suspensions with an ordinary spectrofluorometer, and for individual cells with a microscope spectrofluorometer. Results indicate that: (1) cell-fixation with glutaraldehyde and paraformaldehyde mixture modified phycoerythrin emission from picophytoplankton markedly in its wavelength location and intensity; (2) the emission from phycocyanin was much less affected; (3) the emission from chlorophyll a was not altered. However, the phycoerythrin emission modified by the fixation was found to be easily distinguished from other emissions, and kept its intensity high enough for detection with a fluorescence microscope. Fluorescence properties after fixation were kept unaltered for a long period of time. Based on these results, a simple method is proposed for determining photosynthetic pigments in individual cells in seas and lakes using fluorescence microscopy. Results of tests with natural samples of phytoplankton are presented, and associated problems are discussed. (Author's abstract)
W87-07943

MEASUREMENT OF BACTERIAL CHLOROPHYLL AND ALGAL CHLOROPHYLL A IN NATURAL WATERS,
Marine Biological Lab., Woods Hole, MA.
N. Caraco, and A. H. Puccoon.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 889-893, July 1986. 3 fig, 1 tab, 17 ref.

Descriptors: *Analytical methods, *Chlorophyll, *Chlorophyll a, *Chemical analysis, *Spectral analysis, *Algae, *Photosynthetic bacteria, *Mathematical equations, Bacteria, Aquatic bacteria, Photosynthesis, Pigments, Cyanophyta, Sulfur bacteria, Meromictic lakes, Lakes, Ponds, Coastal waters, Anaerobic conditions, Bottom water, Chemical interference, Eutrophic lakes.

Several groups of chlorophyll-bearing photosynthetic organisms often coexist in anoxic waters. Because of the close similarity between the absorbance spectra of chlorophyll a (in cyanobacteria and algae) and the chlorophylls of green sulfur bacteria (Chl-GSB), it is difficult to distinguish these two groups of organisms where they cooccur. A simple method has therefore been developed to measure both chlorophyll a and Chl-GSB and used in a meromictic coastal pond. In anoxic bottom waters, Chl-GSB was the major pigment present (averaging 20 mg/cu m), but chlorophyll a accounted for from 5 to > 50% of the total pigment present throughout the year. Without this method, large errors in calculated Chl-GSB and chlorophyll a concentrations would have resulted. (Author's abstract)
W87-07955

FLOW-MEASURING SYSTEM FOR USE IN SMALL LAKES,
Duke Univ., Durham, NC. Dept. of Zoology.
S. MacIntyre.
Limnology and Oceanography LIOCAH, Vol. 31, No. 4, p 900-906, July 1986. 6 fig, 3 tab, 24 ref. NSF Grants GB 33310, GB 8328X, BMS 75-03441, and DEB 81-11398.

Descriptors: *Measuring instruments, *Flow measurement, *Lakes, *Water currents, *Internal waves, *Turbulent flow, Flow, Waves, Fluctuations, Calibration, Temperature, Water temperature, Physical properties, Convection, Energy, Hydrodynamics, Flow characteristics, Flow rates.

A detailed evaluation of the warm-bead thermistor flowmeter is presented. Currents, internal waves, and turbulence can be studied with a flowmeter consisting of a heated thermistor in a Wheatstone bridge circuit. Flow is proportional to the imbalance of the Wheatstone bridge caused by cooling of the heated thermistor bead as water flows past. Because the flow-sensing element is spherical, speed can be measured but not direction of flow. The flowmeter can measure speeds as low as 0.1 cm/s and can resolve frequencies up to 5 Hz. Frequency responses were determined by comparison with a laser-Doppler velocimeter and by spectral analysis of field data. At low speeds (< 0.3 cm/s), thermally driven convection contributes to the signal, but flow speeds can be estimated reliably by using a calibration equation that has as one of its parameters the voltage output at zero velocity. (Author's abstract)
W87-07956

HEAVY METAL TRACE DETERMINATION WITH A COMPACT THERMAL IONIZATION QUADRUPOLE MASS SPECTROMETER. PART I. ANALYSIS OF SEWAGE SLUDGES, SOILS AND ANALOGOUS MATERIALS (SCHWERMETALL-SPURENBESTIMMUNG MIT EINEM KOMPAKTEN THERMIONEN-QUADRUPOL-MASSENSPEKTROMETER TEIL 1. ANALYSE VON KLARSCHLAMMEN, BODEN UND VERWANDTEN MATERIALIEN),
Regensburg Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie.
For primary bibliographic entry see Field 5A.
W87-07984

METHOD FOR DETERMINING CONCENTRATIONS OF 220RN IN THE FIELD,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
H. Yoshikawa, M. Yanaga, K. Endo, and H. Nakahara.
Health Physics HLTPAO, Vol. 51, No. 3, p 343-348, September 1986. 4 fig, 2 tab, 12 ref.

Descriptors: *Radon radioisotopes, *Pollutant identification, *Hot springs, *Chemical analysis, *Water analysis, *Field tests, *Measuring instruments, Radioisotopes, Volcanoes, Springs, Groundwater, Groundwater pollution, Water pollution, Geochemistry, Sampling.

A simple and reliable method is presented for determining 220Rn concentrations in fumarole gases by a rapid solvent extraction of Rn into a toluene scintillator solution, followed by activity measurement with a portable liquid scintillation counter designed especially for field work. The counting system consists mainly of one photomultiplier, three channel discriminators, and a data print-out unit. Controls for counting time and cycles are preset. The system records the decay and growth of radioactivities as a function of time and analyzed for the 220Rn and 222Rn components. The method was used for testing the fumarole gases at sites in Japan. The 220Rn concentration in hot spring gases ranged from 0.27 to 30.7 kBq/l gas, and those of 222Rn from 0.026 to 3.04 kBq/l gas. Reproducibility was considered satisfactory under harsh experimental conditions. Although the method was first applied to spring gases, it can be equally well applied to fumarole gas without the surface water by changing the gas sampling device of a separatory funnel to a doubly sheathed stainless steel pipe which was driven into the fumarole. (Doria-PTT)
W87-07992

DROUGHT PREDICTION,
Ibadan Univ. (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 2B.
W87-07996

IDENTIFICATION AND QUANTIFICATION OF ARSENOCHOLINE AND ACETYLARSENOCHOLINE IN TRACE AMOUNTS IN BIOLOGICAL MATERIAL BY USE OF PYROLYSIS GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
National Inst. of Environmental Medicine, Stock-

holm (Sweden).
For primary bibliographic entry see Field 5A.
W87-08064

AIRBORNE MULTISPECTRAL SCANNER DATA FOR ESTIMATION OF DYE DISPERSION FROM SEA OUTFALLS,
Sheffield Univ. (England). Dept. of Geography.
P. J. Curran.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 83, Part 2, p 213-241, March 1987. 9 fig, 8 tab, 23 ref.

Descriptors: *Dye releases, *Remote sensing, *Measuring instruments, *Tracers, *Dispersion, *Path of pollutants, *Waste disposal, *Outfall sewers, Plumes, Dyes, Monitoring, Dilution, Performance evaluation, Spectral analysis, Surveys, Mapping.

For the purpose of monitoring the dispersion and dilution performance of a sewage outfall, dye can be injected into the sewage and the resultant plume tracked by boat. Remotely sensed imagery is now a useful adjunct to survey by boat as it provides a synoptic view of a plume at a instant which, because of tide, wind and current changes, a survey by boat is unable to do. In an experimental survey, airborne multispectral scanner (MSS) imagery and a procedure of modelling, inversion and assessment of accuracy were used to estimate and map the concentration of three dye plumes. Radiometric, atmospheric and irradiance corrections were applied to the airborne MSS data, and a standardized radiance index was highly correlated with dye concentration (r equal to 0.85, significant at the 99% confidence level). This relationship was inverted and extrapolated to all the airborne MSS data, and twenty-two plume plots were produced. For a seven-class classification of dye concentration the plume plots had an accuracy of 49-90% at the 95% confidence level, increasing to 68-100% at the 95% confidence level for a two-class classification. (Author's abstract)
W87-08078

DETERMINATION OF TIN IN SEDIMENTS AND SEWAGE SLUDGES BY ATOMIC ABSORPTION SPECTROMETRY WITH HYDRIDE GENERATION (DETERMINATION DE L'ETAIN DANS LES SEDIMENTS ET LES BOUES DESTATIONS D'EPURATION PAR SPECTRMETRIE D'ABSORPTION ATOMIQUE AVEC GENERATION D'HYDRURES),
Laboratoire Central des Ponts et Chaussees, Bouguenais (France).
M. Legret, and L. Divet.
Analytica Chemica Acta ACACAM, Vol. 189, No. 2, p 313-321, November 1986. 7 tab, 13 ref.

Descriptors: *Pollutant identification, *Measuring instruments, *Analytical methods, *Atomic absorption spectrometry, *Tin, *Sediments, *Sludge, Spectral analysis, Hydrides, Performance evaluation, Sample preparation, Acids.

The conditions for the determination of tin in sediments and sewage sludges by atomic absorption spectrometry with hydride generation are evaluated. Hydride generation is achieved in a 0.4 M nitric acid/0.2 M tartaric acid solution. The effects of hydrochloric, nitric, sulfuric and hydrofluoric acids are discussed. Matrix effect and interferences from other trace elements are studied. Seven sample decomposition procedures are compared. Refluxing with a (1 + 3) nitric acid/hydrochloric acid mixture was the preferred procedure for decomposing such samples. (Author's abstract)
W87-08082

INTERFERENCES IN THE DETERMINATION OF COPPER IN NATURAL WATERS BY ANODIC STRIPPING VOLTAMMETRY,
Commonwealth Scientific and Industrial Research Organization, Sutherland (Australia). Div. of Energy Chemistry.
G. E. Batley.
Analytica Chemica Acta ACACAM, Vol. 189, No. 2, p 371-377, November 1986. 3 fig, 2 tab, 10 ref.

Descriptors: *Measuring instruments, *Pollutant identification, *Analytical methods, *Voltammetry, *Copper, *Natural waters, Anions, Interference, Metals, Complexes, Oxygen, Sample preparation, Cyanides, Spectral analysis.

Copper(I)-binding anions such as cyanide and thiocyanate, and polysaccharides, when present in non-saline waters are shown to produce an additional, more anodic wave during the determination of copper by stripping voltammetry. The origins of this wave and potential interferences in determinations of copper and copper-complexing capacities are discussed. The effect of inadequate oxygen removal is reported. (Author's abstract)
W87-08083

INITIATION OF CONVECTIVE STORMS AT RADAR-OBSERVED BOUNDARY-LAYER CONVERGENCE LINES,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 2B.
W87-08096

RELATIONSHIP BETWEEN LARGE-SCALE CONVECTIVE RAINFALL AND COLD CLOUD OVER THE WESTERN HEMISPHERE DURING 1982-84,
National Oceanic and Atmospheric Administration, Washington, DC. Climate Analysis Center.
For primary bibliographic entry see Field 2B.
W87-08098

INFLUENCE OF DIFFERENT NITROGEN AND IRRIGATION TREATMENTS ON THE SPECTRAL REFLECTANCE OF BARLEY,
Stockholm Univ. (Sweden). Dept. of Physical Geogrpahy.
J. Kleman, and E. Fagerlund.
Remote Sensing of the Environment RSEEA7, Vol. 21, No. 1, p 1-14, February 1987. 10 fig, 1 tab, 10 ref.

Descriptors: *Spectral reflectance, *Barley, *Irrigation effects, *Nitrogen fertilizers, *Spectroradiometers, Biomass, Grain yield, Canopy, Adsorption.

Reflectance measurements were carried out in the field with a spectroradiometer covering the wavelength range 0.4-2.3 micron. Twelve plots of barley were treated in six different ways: two irrigation and three fertilization levels. The spectral reflectances were determined through measurements performed in a nadir looking direction from a mobile platform 15 m above the ground. Reflectance factors of single spectral bands, reflectance factor ratios, and color coordinates were analyzed in relation to biomass, water content of the crop, and grain yield. The blue color coordinate Z was strongly related to the different irrigation levels, and relatively unsensitive to the amount of biomass. The Z coordinate was not well correlated to the IR/red ratio R(0.80)/R(0.68). The IR/red ratio, on the other hand, was strongly coupled to the amount of biomass on each measurement date until approximately 20 July. The average of the IR/red ratio during a period in the middle of the season was strongly related to the grain yield 2 months later. After the onset of senescence, the ratio R(0.80)/R(1.65) was considerably better correlated to the grain yield than was the IR/red ratio. The reflectance factor R(2.19) decreased with increasing canopy water content, up to water contents of 800-1000 g/ sq m. The asymptotic reflectance was then reached and was constant at higher water contents. In the 1.65 micron band the reflectance factor had a minimum at 500-1000 g/sq m and a tendency to increase slightly at high water contents, suggesting that absorption of radiation in water is only one of several factors determining the reflectance at 1.65 micron. (Author's abstract)
W87-08102

DETERMINING RAINFALL INTENSITY AND TYPE FROM GOES IMAGERY IN THE MID-LATITUDES,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
A. A. Tsonis.
Remote Sensing of the Environment RSEEA7, Vol. 21, No. 1, p 29-36, February 1987. 3 fig, 2 tab, 8 ref.

Descriptors: *Remote sensing, *Satellite technology, *GOES imagery, *Rainfall intensity, *Precipitation, Cloud temperature, Brightness, Storms, Convective precipitation.

Although a useful estimate of the areal extent of precipitation from visible and infrared satellite data can be made, the extraction of rainfall rates is still a problem. Earlier work by the author suggested that little, if any, correlation exists between rainfall rate and brightness or cloud top temperature individually. The results of this work indicate that by employing pattern matching techniques it may be possible to objectively define a satellite delineated rain area in terms of light-moderate and moderate-heavy. Further, convective and nonconvective precipitation areas can be separated. (Author's abstract)
W87-08103

ENVIRONMENTAL EFFECTS ON LASER-INDUCED FLUORESCENCE SPECTRA OF NATURAL WATERS,
Cornell Univ., Ithaca, NY.
A. Vodacek, and W. D. Philpot.
Remote Sensing of the Environment RSEEA7, Vol. 21, No. 1, p 83-95, February 1987. 10 fig, 1 tab, 29 ref. NASA Grant NGT 33-010-800.

Descriptors: *Analytical methods, *Monitoring, *Laser fluorosensing, *Dissolved organic carbon, *Natural waters, Attenuation, Lasers, Temperature, Metals, Ions, Fluorescence, Field tests.

Laser fluorosensing can be used to monitor dissolved organic carbon (DOC), but analysis of the data can be hindered by several environmental phenomena. These phenomena include attenuation of the laser beam and differential attenuation of the fluorescence by the water column, variability in the molecular weight composition of the DOC, and temperature, pH, and metal ion effects on DOC fluorescence. These factors are discussed in terms of their effect on laboratory and remote field data analysis. Experimental results are provided. An improved methodology is discussed, and a suggestion is made for indirect monitoring of pH and metal ion concentration. (Author's abstract)
W87-08104

MEASUREMENT OF THE SURFACE EMISSIVITY OF TURBID WATERS,
Delaware Univ., Lewes. Coll. of Marine Studies.
L. Wen-Yao, R. T. Field, R. G. Gantt, and V. Klemas.
Remote Sensing of the Environment RSEEA7, Vol. 21, No. 1, p 97-109, February 1987. 2 fig, 5 tab, 9 ref. NSF Grant CEE-8210857.

Descriptors: *Surface emissivity, *Turbid water, *Remote sensing, *Satellite technology, *Radiometric temperature measurement, Sediments, Suspended solids, Coastal waters.

Knowledge of sea surface emissivity is an important factor in measuring valid thermal IR radiometric temperatures from viewing positions both near the sea surface and from satellite platforms. In the latter case, it is found that the effect of as little as a 0.01 change in emissivity from a blackbody assumption may create an increase of as much as 1.0 D in recovered temperature in dry atmospheres where recovered temperatures are radiometric temperatures obtained by applying the Planck function to radiances received at the satellite. As atmospheric moisture increases to around 5 g/sq cm, variations in emissivity of the same order have negligible effect on recovered sea surface temperatures. Laboratory measurements of fresh (tap) and sea water samples with a Barnes 8-14 micron PRT-5 radiometer show distinctive differences in the behavior of emissivity with changes in suspended sediment concentrations for both organic and inorganic materials. Tap water emissivity remains essentially invariant at 0.980 over a wide range of concentrations. In contrast, however, sea water

emissivity values show an immediate but steady decrease from 0.975 to a value 0.970, with increasing suspended sediment loading up to around 100 mg/L, where emissivity levels off until it falls again to a value of 0.962 at concentrations of 10,000 mg/L. Consequently, emissivity variations should not be neglected in making thermal measurements of coastal waters. (Author's abstract)
W87-08105

STRUCTURE OF A TYPHOON RAINBAND OBSERVED BY TWO DOPPLER RADARS,
Meteorological Research Inst., Yatabe (Japan).
For primary bibliographic entry see Field 2B.
W87-08129

EFFECT OF INORGANIC PARTICULATES ON THE ASV SIGNALS OF CD, PB AND CU,
Newcastle Univ. (Australia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W87-08131

RIVER WATER QUALITY MONITORING,
Oklahoma Univ., Norman. Environmental and Ground Water Inst.
For primary bibliographic entry see Field 7A.
W87-08165

FIELD DATA COLLECTION AT ABANDONED WASTE DISPOSAL SITES: PROBLEMS IN DATA GATHERING,
Ethura, McLean, VA.
B. J. Mason.
IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 359-367, 1 tab, 3 ref.

Descriptors: *Data acquisition, *Waste disposal, *Disposal sites, *Sampling, *Love Canal, *New York, Safety, Public relations, Legal aspects.

Abandoned hazardous waste site investigations present a challenge to the environmental scientists that few researchers encounter in the course of their careers. An abandoned hazardous waste disposal site can occur in many settings. Some, such as the farm sites in southern Missouri where dioxin-contaminated wastes were deposited in pits located on several farms, are difficult to locate and may go unnoticed for years. Others, such as the Kin-Buc landfill in Edison, New Jersey, or Love Canal in Niagara Falls, New York, are in urban areas where problems are often noticed shortly after they surface. General awareness of the problems create public pressures to 'do something fast,' creating a situation that can become explosive if not handled properly by the authorities. The role of the environmental researcher in field investigations at abandoned hazardous waste sites is presented. Problems of legal, safety, and quality assurance aspects are discussed from the perspective of one of the major environmental studies undertaken in recent years - the Love Canal field studies conducted by the U.S. Environmental Protection Agency. Sampling - purpose, plan, collection and transportation as well as the importance of a good public relations program are emphasized. Insight gained through 2 years of work on several abandoned waste sites located in the eastern United States is provided. (See also W87-08166) (Lantz-PTT)
W87-08190

PRELIMINARY DESIGN FOR A SORBING TRACER TEST IN THE CULEBRA DOLOMITE AT THE H-3 HYDROPAD AT THE WASTE ISOLATION PILOT PLANT (WIPP) SITE,
INTERA Technologies, Inc., Austin, TX.
For primary bibliographic entry see Field 5B.
W87-08199

PRACTICAL MANUAL FOR DETERMINING SETTLING RATES OF OCEAN DISPOSED SEWAGE SLUDGE,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5E.
W87-08227

PROJECT SKYWATER 1985-86 CRADP DATA INVENTORY: COLORADO RIVER AUGMENTATION DEMONSTRATION PROJECT.
Water and Power Resources Service, Denver, CO. Office of Atmospheric Resources Management.
For primary bibliographic entry see Field 2B.
W87-08235

EVALUATION OF MICROEXTRACTION/CAPILLARY COLUMN GAS CHROMOTOGRAPHY FOR MONITORING INDUSTRIAL OUTFALLS,
Occidental Chemical Corp., Grand Island, NY. Research Center.
For primary bibliographic entry see Field 5A.
W87-08272

SATELLITE OBSERVATIONS OF HURRICANE ELENA (1985) USING THE VAS 6.7-(MU)M 'WATER-VAPOR' CHANNEL,
Wisconsin Univ.-Madison. Space Science and Engineering Center.
C. S. Velden.
Bulletin of the American Meteorological Society BAMIAT, Vol. 68, No. 3, p 210-215, March 1987. 4 fig, 17 ref. NOAA Contract NA-84-DGC-0155.

Descriptors: *Remote sensing, *Satellite technology, *Hurricane Elena, *Water vapor, Computers, Hurricanes, Storms, Meteorology, Weather, Troughs, Gulf of Mexico.

Satellite imagery from the VISSR (Visible Infrared Spin Scan Radiometer) Atmospheric Sounder (VAS) 6.7-micron water-vapor absorption band is normally available to the National Hurricane Center (NHC) in real time (half-hourly intervals, 16 hours a day) through a remote Man-computer Interactive Data Access System (McIDAS) workstation located in the forecast center. Synoptic features that are not readily apparent in 'visible' imagery or '11-micron-infrared' imagery are often well defined in the VAS 'water-vapor' imagery with the help of special enhancement software that exists on McIDAS. A good example is Hurricane Elena (1985). Its erratic path in the Gulf of Mexico was responsible for the evacuation of nearly a million people in low-lying coastal areas during a three-day period. Imagery from the VAS 6.7-micron water-vapor channel clearly shows the interaction of a midlatitude trough with the hurricane, and supports other evidence that suggests this was responsible for altering Elena's course. (Author's abstract)
W87-08313

EXAMPLE OF HURRICANE TRACKING AND FORECASTING WITH A GLOBAL ANALYSIS-FORECASTING SYSTEM,
European Centre for Medium Range Weather Forecasts, Reading (England).
W. A. Heckley, M. J. Miller, and A. K. Betts.
Bulletin of the American Meteorological Society BAMIAT, Vol. 68, No. 3, p 226-229, March 1987. 1 fig, 17 ref. NSF Grant ATM-8403333.

Descriptors: *Model studies, *Remote sensing, *Hurricane tracking, *Weather forecasting, *Global analysis, *Hurricane Elena, Aircraft, Radar, Clouds, Convection, Hurricanes, Forecasting, Storms.

The tracking of Hurricane Elena by the ECMWF operational analysis system is compared with reported positions from reconnaissance aircraft and coastal radar. An example forecast is shown for the operational model and also for an experimental version of the model. A strong sensitivity to the parameterization of deep cumulus convection is found. (Author's abstract)
W87-08315

WEIR FLOWS,
Wisconsin Univ.-Madison. Dept. of Mathematics.
For primary bibliographic entry see Field 8B.
W87-08318

COMPUTER BASED CULTURING SYSTEM FOR MEASURING THE PHOTOSYNTHETIC RESPONSE OF PHYTOPLANKTON TO A FLUCTUATING ENVIRONMENT,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
R. L. Miller.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 106, No. 1, p 17-29, March 1987. 8 fig, 1 tab, 23 ref.

Descriptors: *Measuring instruments, *Culturing systems, *Photosynthesis, *Estuaries, *Limnology, *Phytoplankton, *Analytical methods, *Computers, Automation, Cultures, Temperature, Salinity, Model studies, Transport, Data acquisition, Simulation.

A microcomputer-controlled culturing system developed to simulate temperature and salinity fluctuations in an estuary is described. The system consists of a microcomputer, interfacing hardware, a continuous culture apparatus, and system software. The system can regulate the temperature and salinity of a continuous phytoplankton culture based on user-defined models of the physical environment and particle transport in a natural environment. The microcomputer also provides efficient data acquisition and data storage. The system was designed to facilitate expansion and modification and can easily be adapted to accommodate various studies of phytoplankton production. Details of a simulation and representative data are presented. (Author's abstract)
W87-08319

SOIL WATER SATURATION: DIELECTRIC DETERMINATION,
Oklahoma State Univ., Stillwater. Dept. of Physics.
A. Alharthi, and J. Lange.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 591-595, April 1987. 2 fig, 3 tab, 7 ref.

Descriptors: *Dielectric measurements, *Measuring instruments, *Soil water, *Saturated soils, Mathematical equations, Saturation, Dielectric constant.

Dielectric measurements of moist soils are used to determine water saturations. The degree of saturation of water is determined using a mixing law for the composite structure (soil, water, and air) which is verified experimentally. For the lower water saturation range (<60%), a particularly simple form for the relationship between fractional water content theta and measured dielectric constant can be formulated. In particular, for sandy soils at 23 C, the fractional water content is given by theta = square root (0.128 epsilon sub c) - 0.204. (Author's abstract)
W87-08335

SUBMICRON SIZE DISTRIBUTIONS OF INORGANIC SUSPENDED SOLIDS IN TURBID WATERS BY PHOTON CORRELATION SPECTROSCOPY,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
C. L. Gallegos, and R. G. Menzel.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 596-602, April 1987. 4 fig, 5 tab, 13 ref.

Descriptors: *Water quality data, *Analytical methods, *Measuring instruments, *Photon correlation spectroscopy, *Suspended solids, *Turbidity, Particulate matter, Runoff, Size distribution, Sample storage.

Photon correlation spectroscopy (PCS) is a technique for determining size distributions of submicron sized particles. A particle diffusion coefficient, which is dependent on particle diameter, is determined from measurements of the autocorrelation function of the intensity fluctuations of light scattered from a laser beam passing through a

suspension of particles. We demonstrate the applicability of the technique to particles likely to be found in runoff or turbid impoundments using soil fractions prepared to have a known size distribution. Mean particle diameters of all soil fractions determined by PCS fell within the expected range. Particle-size distributions of natural water samples were reproducible when analyzed within minutes of collection. The effects of sample storage and pretreatment varied between water bodies and thus can be a source of uncertainty in the results. Particles from a turbid creek carrying storm runoff began to coagulate within 2.5-6 hours, whereas particles from a perennially turbid impoundment remained stable for 10 days. Addition of sodium hexametaphosphate improved the reproducibility of the particle-size distribution with prolonged storage. Applications of the technique include determination of coagulation rates and critical coagulation concentrations of electrolytes, and calculation of settling velocity distributions of submicron particles in turbid natural waters. (Author's abstract)
W87-08336

USING GOES THERMAL INFRARED DATA TO MAP FREEZE ZONES FOR CITRUS AND CONSEQUENCES FOR WATER MANAGEMENT,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
S. F. Shih, and E. Y. Chen.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 737-743, April 1987. 5 fig, 21 ref. NOAA Contract NA80AA-D-00129.

Descriptors: *Frost, *Frost forecasting, *Remote sensing, *Satellite technology, *GOES, *Freeze zones, *Mapping, *Citrus, *Water management, Frost protection, Florida, Temperature effects, Risk assessment, Drought effects, Drought, Freezing, Weather.

Geostationary Operational Environmental Satellite (GOES) thermal infrared data were used to study Florida citrus damage from four major freeze events during the period 1963-1982 and the impact on water management. The 1963 freeze predated satellite data, but extrapolations were made using the average low temperature obtained from recent satellite data. The results showed that satellite temperature patterns closely matched the citrus damage patterns. Consistent patterns of lower temperature for the west coast area and the interior portion of central Florida were found and were used to identify high-risk freeze areas. Severe citrus damage for a large area in south central Florida north and west of Lake Okeechobee appears to be attributable to the drier surface resulting from severe drought. (Author's abstract)
W87-08352

RESERVOIR WATER QUALITY DATA COLLECTION,
Army Engineer District, Wilmington, NC.
C. C. Meshaw.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas Texas. p 40-48, 1 fig, 1 tab, 8 ref.

Descriptors: *Water quality, *Data collections, *Reservoirs, Resource management, Reservoir operation, Environmental effects, Aquatic environment, Water sampling, Lakes.

A program for the collection of water quality data at B. Everett Jordan Lake is described. The program was designed to produce reliable data primarily through the use of standard methods. Several references for standard methods and guidance manuals for data collection are listed. The major water quality concerns about the reservoir were trace metals and mercury in fish, eutrophication, and bacteria. The primary objectives of the data collection program were to define first-year impoundment water quality conditions for future comparisons, identify water quality problems, and assist the state and local agencies responsible for watershed pollution control in evaluating the need for impacts of control measures. The need for high quality data collection programs to increase chances of acceptance and use by agencies involved, is discussed. (See also W87-08365) (Halterman-PTT)
W87-08369

DEVELOPING DATA FOR RESIDENTIAL WATER SAVINGS,
Brown and Caldwell, Walnut Creek, CA.
For primary bibliographic entry see Field 3D.
W87-08453

DEVELOPMENT OF HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC METHODS FOR SEPARATION AND AUTOMATED COLLECTION OF TETRACHLORODIBENZO-P-DIOXIN ISOMERS,
Wright State Univ., Dayton, OH. Brehm Lab.
For primary bibliographic entry see Field 5A.
W87-08480

EVALUATION OF XAD-2 RESIN CARTRIDGE FOR CONCENTRATION/ISOLATION OF CHLORINATED DIBENZO-P-DIOXINS AND FURANS FROM DRINKING WATER AT THE PARTS-PER-QUADRILLION LEVEL,
Health and Welfare Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 5A.
W87-08481

COMPARISON OF A NEW RAPID EXTRACTION GC/MS/MS AND THE CONTRACT LABORATORY PROGRAM GC/MS METHODOLOGIES FOR THE ANALYSIS OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN,
Satterthwaite Associates, Inc., West Chester, PA.
For primary bibliographic entry see Field 5A.
W87-08484

APPROACHES TO THE DETERMINATION OF LIMIT OF DETECTION IN 2,3,7,8-TCDD ANALYSES,
Weston (Roy F.), Inc., Kansas City, KS.
For primary bibliographic entry see Field 5A.
W87-08487

X-RAY PHOTOCONDUCTIVITY MEASUREMENTS OF EXAFS IN LIQUIDS: TECHNIQUES AND APPLICATIONS,
Brookhaven National Lab., Upton, NY. Chemistry Dept.
For primary bibliographic entry see Field 5A.
W87-08494

AUTOMATIC MONITORING OF SURFACE WATER QUALITY: THE WARNING STATION OF LE MONT VALERIEN WATER TREATMENT PLANT,
Centre de Recherche Lyonnaise des Eaux - Degremont, Le Pecq (France).
For primary bibliographic entry see Field 5A.
W87-08519

FLOW OVER SHARP-CRESTED PLATE WEIRS,
Concordia Univ., Loyola Campus, Montreal (Quebec). Dept. of Engineering.
A. S. Ramamurthy, U. S. Tim, and M. V. J. Rao.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 113, No. 2, p 163-172, May 1987. 7 fig, 1 tab, 15 ref, append.

Descriptors: *Stream gaging, *Stream gages, *Gaging, *Discharge coefficient, *Weirs, *Flows, *Hydrodynamics, *Channels, Pressure distribution, Velocity, Momentum.

For flow past a two-dimensional sharp-crested weir located at the end of a horizontal rectangular channel, experimental results related to velocity and pressure distributions in the region of the nappe close to the weir crest section and the pressure distribution on the weir face were obtained. Based on experimental results and simplified theoretical considerations, a general relationship between the weir discharge coefficient C sub d and the parameter H/W (or W/H) is determined using the momentum principle. The present experimental results corroborate the proposed relationship for the weir discharge coefficient. (Author's abstract)
W87-08581

ULTRATRACE ANALYSIS OF MERCURY AND METHYLMERCURY (MM) IN RAIN WATER USING COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRY,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
For primary bibliographic entry see Field 5A.
W87-08599

7C. Evaluation, Processing and Publication

SIMPLE METHOD FOR GENERATING DAILY RAINFALL DATA,
California Univ., Davis. Dept. of Agronomy and Range Science.
For primary bibliographic entry see Field 2B.
W87-07608

DETERMINATION OF THE SPEED OF MOVING RAINFALL PATTERNS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
For primary bibliographic entry see Field 2B.
W87-07611

SOLUTION OF CONTAMINANT TRANSPORT EQUATIONS USING AN ORTHOGONAL-UPSTREAM FINITE ELEMENT SCHEME,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W87-07752

COMPUTER PROGRAM, IN FORTRAN IV-PLUS, FOR ONE-DIMENSIONAL HEAT AND MOISTURE MOVEMENT IN THE GROUND WITH AND WITHOUT ANY ARTIFICIAL HEAT SINKS OR SOURCES,
Tampere Univ. of Technology (Finland). Thermal Engineering Lab.
For primary bibliographic entry see Field 2F.
W87-07753

GRAVITY MODELING OF THE BRIMFIELD TOWNSHIP BURIED VALLEY AND ASSOCIATED AQUIFER, PORTAGE COUNTY, OHIO,
Kent State Univ., OH. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W87-07851

TECHNIQUE TO EVALUATE AQUIFER CONSTANTS BY PUMPING TEST DATA OF A CAVITY WELL,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Irrigation and Drainage Engineering.
For primary bibliographic entry see Field 2F.
W87-07855

MICROCOMPUTER PROGRAM FOR INTERPRETING TIME-LAG PERMEABILITY TESTS,
SRW Associates, Inc., Pittsburgh, PA.
D. B. Thompson.
Ground Water GRWAAP, Vol. 25, No. 2, p 212-218, March-April 1987. 4 fig, 6 ref, 3 append.

Descriptors: *Computer programs, *Data processing, *Data interpretation, *Groundwater movement, *Computers, *Wells, *Groundwater, *Permeability, Test wells, Water level, Water level fluctuations, Permeability coefficient, Estimating, Field tests.

Single-well tests based on the rate of water-level recovery after raising or lowering the water level

in a well have long been used as a quick and simple method of obtaining order-of-magnitude estimates of hydraulic conductivity. The BASIC program presented allows for the rapid interpretation of these tests for most field situations. (Author's abstract)
W87-07856

PITFALLS IN INTERPRETATION OF SOIL DRAINAGE FROM SOIL SURVEY INFORMATION,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
For primary bibliographic entry see Field 2G.
W87-07907

COMPUTER-ASSISTED MAPPING OF IRRIGATION WATER REQUIREMENTS FOR VANCOUVER ISLAND BASED ON SOIL AND AGRICULTURAL CAPABILITY SURVEY DATA,
British Columbia Ministry of Environment, Victoria. Water Management Branch.
N. K. Nagpal, M. W. Sondheim, and C. H. Wallis.
Canadian Journal of Soil Science CJSSAR, Vol. 66, No. 3, p 471-480, August 1986. 1 fig, 5 tab, 10 ref.

Descriptors: *Computers, *Mapping, *Irrigation requirements, *Soil surveys, *Vancouver Island, *Data interpretation, *Agronomy, *Surveys, Algorithms, Land use, Agriculture, Cropland, Irrigation, Engineering, Agricultural engineering, Roots, Crop production, Risks, Water table, Irrigable land.

A method is presented for computer-assisted mapping of volumetric irrigation water requirement as applied to the east coast of Vancouver Island, British Columbia. Soil and agricultural capability maps at 1:20,000 scale were digitized and the corresponding field and laboratory data were stored in a computer mapping system. An algorithm generates the volume of water required for each polygon by multiplying an area by a depth. The area is the number of arable hectares in the polygon. The depth is calculated as a weighted average of the individual irrigation depths for the arable soils within the polygon, where arability is tied to the attributes of each soil as compared to agricultural capability criteria. Using a water requirement model, the irrigation depth for a given soil is defined as a function of available water storage capacity, estimated to an assumed rooting depth for various crops, or to a root restricting layer; level of risk; and depth to the water table. Polygons needing water are displayed on the resulting maps with a label depicting the required volume. Tabular summaries are provided on a polygon and mapsheet basis. (Author's abstract)
W87-07916

ANALYSIS OF SPATIAL INHOMOGENEITIES IN CUMULUS CLOUDS USING HIGH SPATIAL RESOLUTION LANDSAT DATA,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 7B.
W87-07930

LOGNORMAL FIT TO RAINDROP SPECTRA FROM FRONTAL CONVECTIVE CLOUDS IN ISRAEL,
Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
For primary bibliographic entry see Field 2B.
W87-07932

SPATIAL COHERENCE OF AFRICAN RAINFALL ANOMALIES: INTERHEMISPHERIC TELECONNECTIONS,
Clark Univ., Worcester, MA. Dept. of Geography.
For primary bibliographic entry see Field 2B.
W87-07933

APPLICATION OF PATTERN RECOGNITION TO THE EVALUATION OF CONTAMINATION FROM OIL SHALE RETORTING,
Colorado Univ. at Denver. Center for Environmental Sciences.

IN: Environment and Solid Wastes: Characterization, Treatment, and Disposal. Proceedings of the Fourth Life Sciences Symposium, Environment and Solid Wastes, Gatlinburg, Tennessee, October 4-8, 1981. Butterworth Publishers, Boston, Massachusetts. 1983. p 369-381, 5 fig, 2 tab, 3 ref.

Descriptors: *Pattern recognition, *Data interpretation, *Oil shale, *Path of pollutants, *Groundwater pollution, Leaching, Industrial wastes, Monitoring, Groundwater quality.

From a trace element point of view, the single most important characteristic of the oil shale process is the large amount of material that must be processed. To obtain a million barrels of oil per day, 480 million ton/yr of shale must be processed. If the operation uses an aboveground retort, the retorted shale will be disposed of on the surface; if an in situ operation is used, it will be underground. Thus, rather prodigious amounts of trace elements will be handled, and potential contamination of surface and subsurface waters may occur as a result of leaching. A large program to monitor water quality near a test underground retort has produced large quantities of data. An interpretive analysis of these data, using multidimensional pattern recognition techniques, has been undertaken. This chapter describes how pattern recognition techniques may be used to assist in selecting parameters to be measured, measurement techniques, sampling frequency, location of sampling sites, and related activities. (See also W87-08166) (Author's abstract)
W87-08191

GRAPHICAL APPROACH TO PRINCIPAL COMPONENT ANALYSIS: UTILIZATION IN HYDROBIOLOGY (APPROCHE GRAPHIQUE DE L'ANALYSE EN COMPOSANTES PRINCIPALES NORMEE: UTILISATION EN HYDROBIOLOGIE),
Lyon-1 Univ., Villeurbanne (France).
G. Carrel, D. Barthelemy, Y. Auda, and D. Chessel.
Acta Oecologica, Oecologia Generalum, Vol. 7, No. 2, p 189-203, 1986. 6 fig, 2 tab, 20 ref, append.

Descriptors: *Limnology, *Principal component analysis, *Graphical methods, *Physicochemical properties, Statistical methods, Rhone River, Rivers.

Principal component analysis (biplot graphs, correlation circles and component score maps) are well suited to describe and interpret the physicochemical characteristics of fresh waters. This article describes the use of canonical factor-variable graphs as well as representations of data superimposed on linear models as new methods of analysis. This perspective is theoretically supported and is presented through graphic illustration, including treatment of data obtained over the course of Feb '83 - Feb '84 at a point on the Rhone, 70 km upriver from Lyon. The data were analyzed for 15 variables representing physiocochemical properties. (Airone-PTT)
W87-08286

BOUNDARY ELEMENT - FINITE ELEMENT PROCEDURE FOR POROUS AND FRACTURED MEDIA FLOW,
Pennsylvania State Univ., University Park. Dept. of Mineral Engineering.
For primary bibliographic entry see Field 2F.
W87-08331

ESTIMATION OF THE GENERALIZED COVARIANCE WHEN IT IS A LINEAR COMBINATION OF TWO KNOWN GENERALIZED COVARIANCES,
Instituut TNO voor Wiskunde, Informatieverwerking en Statistiek, Delft (Netherlands). Inst. of Applied Computer Science.
L. G. Barendregt.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 583-590, April 1987. 3 fig, 2 tab, 9 ref, append.

Descriptors: *Model studies, *Data interpretation, *Estimating, *Covariance, *Kriging, Maximum likelihood, Mathematical studies.

In order to be able to perform a spatial interpolation according to the kriging method, one must know the generalized covariance of the underlying intrinsic random field. Recently, P. K. Kitanidis (1983) described how this generalized covariance can be estimated by making use of the maximum likelihood method. Here, it will be described how this estimation can be simplified if the model for the generalized covariance is linear with two parameters. The computations are based on a particular set of generalized increments, the so-called principal increments. These increments can also serve as a starting point for a study of the mathematical properties of the maximum likelihood estimators. (Author's abstract)
W87-08334

MAXIMUM LIKELIHOOD ESTIMATORS FOR THE MULTISITE LAG-ONE STREAMFLOW MODEL: COMPLETE AND INCOMPLETE DATA CASES,
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W87-08341

STUDY OF CELL MODELS: 1. A MANIFOLD CELL MODEL FOR DISTRIBUTED SURFACE RUNOFF SYSTEMS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
G. G. S. Pegram, and M. H. Diskin.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 646-654, April 1987. 8 fig, 1 tab, 11 ref, 2 append.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Runoff, *Model studies, *Cell models, *Catchments, *Data interpretation, Hydrographs, Watersheds.

As a means of examining the behavior of distributed linear models of catchments (and in particular the cell model) a series of investigation were carried out on the modeling of a long, narrow, rectangular hypothetical catchment. Impulse response functions of three models were studied; the conventional cascade; a modified cascade which can be modeled in series or in parallel; and a new model called the manifold cell model which is characterized by its exclusively parallel nature. The response function of the cascade model converges to a rectangular pulse, and that of the modified cascade model converges to a modified pulse. The impulse response function for the manifold cell model converges to a family of shapes that 'look like' hydrographs, i.e., that are intuitively acceptable. The manifold cell model approaches its asymptotic response with a modest number of cell divisions of the same order as the typical discretization along the longest watercourse of a natural watershed. (See also W87-08343 and W87-08344) (Author's abstract)
W87-08342

STUDY OF CELL MODELS: 2. THE EFFECT OF TIME DELAY ON THE LIMITING FORMS OF CASCADE AND MANIFOLD CELL MODEL RESPONSE FUNCTIONS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
G. G. S. Pegram, and M. H. Diskin.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 655-662, April 1987. 4 fig, 1 tab, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Model studies, *Cell models, *Data interpretation, *Impulse response function, Time delay, Hydrology, Runoff, Overland flow, Equations.

A simplified cell model was used to investigate the behavior of the impulse response function (IRF) of cell models incorporating time delay elements, as

the number of subdivisions increases. The simplified model used in this study was a single branch model consisting of a number of equal cells arranged in sequence. Two cell models were studied, a cascade model and a manifold model. In this study the model representing each cell is modified by the addition of a delay element which is taken to be linearly proportional to the distance of its corresponding cell from the outlet. The limiting forms of the IRFs are derived for the two models using Laplace transforms; the cascade cell model IRF is found to converge to a rectangle regardless of the values of its parameters, while the manifold cell model IRF converges to a family of curves whose shapes depend quite sensitively on the values of the parameters chosen. The expression derived contains the exponential integral function, which has not been used before in surface hydrology. For some combinations of the parameters, the IRF has the classical (or intuitively expected) shape consisting of a steep rise and mild recession. For other values, the IRF is reminiscent of the kinematic wave solution to the overland flow equations, and some comparisons are made. The manifold cell model is found to hold promise as a suitably behaved alternative to the cascade cell model in the context of distributed surface runoff systems. (See also W87-08342 and W87-08344) (Author's abstract)
W87-08343

STUDY OF CELL MODELS: 3. A PILOT STUDY ON THE CALIBRATION OF MANIFOLD CELL MODELS IN THE TIME DOMAIN AND IN THE LAPLACE DOMAIN,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
M. H. Diskin, and G. G. S. Pegram.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 663-673, April 1987. 2 fig, 3 tab, 16 ref, append.

Descriptors: *Streamflow forecasting, *Rainfall-runoff relationships, *Data interpretation, *Model studies, *Cell models, *Calibrations, Hydrologic models, Laplace equation, Equations.

The results of the calibration of a hydrologic system model depend, among other factors, on the formulation of the model structure and the procedure adopted for the computations. The variation between different methods is relatively small, but it is possible to gain some side benefits by using one method or another. The paper describes the results obtained with different formulations of two semi-distributed cells models, a cascade model previously described in the technical literature, and a new manifold model. Two equivalent formulations were used for the definition of the models. One was based on the use of convolution integrals, and the second was based on a discretely coincident autoregressive moving average formulation. In addition, a rarely used approach based on Laplace transforms is also described. Results obtained by this method indicate that it has some merits, such as robustness and convergence, which make it an attractive calibration technique. (See also W87-08342 and W87-08343) (Author's abstract)
W87-08344

APPLICATION OF NONLINEAR FILTERING IN THE REAL TIME FORECASTING OF RIVER FLOWS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
C. E. Puente, and R. L. Bras.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 675-682, April 1987. 6 fig, 3 tab, 17 ref. DOC Cooperative agreement NA 80AA-H-00D44.

Descriptors: *Streamflow forecasting, *Runoff, *River flow, *Data interpretation, *Flow forecasting, *Nonlinear filters, *Model studies, Stochastic process, Case studies, Watersheds, Prediction, Algorithms.

The practical use of nonlinear filters on conceptual stochastic watershed models is investigated. Results obtained on a case study emphasize the importance of the assumed noise components of the watershed model. Depending on such noises, runoff predictions could range from excellent to unacceptable. The simpler of the nonlinear filters considered, the extended Kalman filter, was found to be, when effective, as good as other, more complicated filters. Although smoothing algorithms lead to improvements, their computational burden may be unacceptable. (Author's abstract)
W87-08345

SIMULATION OF CONTAMINANT TRANSPORT IN THREE DIMENSIONS: 1. THE ALTERNATING DIRECTION GALERKIN TECHNIQUE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
R. D. Burnett, and E. O. Frind.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 683-694, April 1987. 9 fig, 5 tab, 27 ref. NSERC (Canada) Grant A8368.

Descriptors: *Groundwater movement, *Path of pollutants, *Simulation, *Data interpretation, *Galerkin technique, Groundwater, Algorithms, Flow, Field tests.

The alternating direction Galerkin technique for the simulation of advective-dispersive transport in three dimensions is developed. The technique is designed for high efficiency in handling the large and detailed grids that are often required in simulations of natural groundwater systems. It is comparable to an alternating direction finite difference scheme, except for two advantages: first, the capability to handle certain curvilinear grids that may conform to either a flow net geometry or a natural stratigraphy and, second, the option to enhance solution accuracy through a choice between a finite difference or a finite element representation of the time derivative. Criteria for controlling numerical dispersion and accuracy can be applied easily. Three options for the time-stepping algorithm are developed and analyzed for stability, and their accuracy is investigated for simple flow systems. The technique is shown to be far more efficient than a conventional three-dimensional finite element model. In a companion paper, an application to a field-scale contaminant transport problem is described. (See also W87-08347) (Author's abstract)
W87-08346

SIMULATION OF CONTAMINANT TRANSPORT IN THREE DIMENSIONS: 2. DIMENSIONALITY EFFECTS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
R. D. Burnett, and E. O. Frind.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 695-705, April 1987. 12 fig, 3 tab, 17 ref. NSERC (Canada) Grant A8368.

Descriptors: *Path of pollutants, *Simulation, *Data interpretation, *Groundwater movement, *Galerkin technique, Field tests, Plumes, Estimating.

The alternating direction Galerkin technique developed in the first paper of this series is applied to the simulation of field-scale contaminant transport scenarios in two and three dimensions, and dimensionality effects are examined. In the case of vertical-plane simulation, the dimensionality effect, which becomes noticeable at a transverse dispersivity of only 1 cm, can result in significant overestimation of plume length. In the case of vertically averaged horizontal plane simulation, the apparent length of a plume defined in terms of vertical averages will be much less than that of the equivalent plume defined in terms of peak concentrations. Only the three-dimensional simulation is capable of producing the actual concentration values that drive local processes such as chemical reactions. The cost of the three-dimensional simulations, while substantially greater than that of the two-dimensional simulations, is shown to be reasonable. (See also W87-08346) (Author's abstract)
W87-08347

FITTING JOHNSON S SUB B CURVE BY THE METHOD OF MAXIMUM LIKELIHOOD TO ANNUAL MAXIMUM DAILY RAINFALLS,
Birmingham Univ. (England). Dept. of Civil Engineering.
N. T. Kottegoda.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 728-732, April 1987. 3 fig, 2 tab, 23 ref.

Descriptors: *Rainfall forecasting, *Rainfall, *Data interpretation, *Maximum likelihood, *Estimating, Distribution, Kurtosis, Precipitation, Weather, Statistics.

A new method of fitting the Johnson S sub B distribution using maximum likelihood (ML) procedures is described. Commencing with assumed values for the location and scale parameters, estimates of all four parameters are found iteratively. This does not have the disadvantages of the method of moments for which estimates of the higher moments are required and the ambiguities of the method of percentiles in which estimates of parameters depend on the choice of percentiles. Application is made to sequences of annual maximum daily rainfalls in which the kurtosis is low when compared with that corresponding to the theoretical lognormal distribution for the observed skewness. In some cases the ML procedure is not feasible. Problems encountered with ML estimation and inadequacies arising from short samples on the choice of distribution are discussed. (Author's abstract)
W87-08350

WATER QUALITY DATA MANAGEMENT,
Army Engineer District, Nashville, TN.
J. K. Brown.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 54-57.

Descriptors: *Water management, *Water quality control, Water quality, Water sampling, Data management, Water resources development, Water use, Resources development.

A computerized storage and retrieval system for managing water quality data is presented. The primary elements of the system include assembling field and lab data in machine-readable form, assembling supporting data, entering data onto computer and converting it to proper format, checking all information entered and correcting errors, calculating values from observed data, developing and maintaining programs and files, maintaining logs showing available data, and exchanging data with other investigators. The system described is currently being used to successfully manage grab samples and continuous record data in the AURAS system. Each value or concentration stored in AURAS required information on the STORET parameter code (5 digit); station identification (9 digit); date by year, month and day (6 digit); time (4 digit) and depth (3 digit). (See also W87-08365) (Halterman-PTT)
W87-08371

WATER QUALITY DATA INTERPRETATION,
Army Engineer District, Rock Island, IL.
C. A. Beckert.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through water Management Procedures, February 17-18, 1982, Dallas, Texas. p 58-71, 8 fig, 10 ref.

Descriptors: *Water quality control, *Water resources management, Water resources development, Water quality, Resources development, Data management, Data interpretation, Data processing.

The various steps leading to successful data interpretation in water quality studies are reviewed, and some interpretative techniques are offered. The major topics discussed include the need for familiarity with the study area, the importance of ascertaining precision and accuracy of the data set, evaluation of the appropriateness of the data to answer proposed questions, and the use of various statistical techniques. The importance of the data interpretation step in water quality investigations is stressed. This step is dependent upon a thorough knowledge of the entire collection-analysis system as well as the use of proper interpretative tech-

niques. Several factors affecting data interpretation are discussed, and some interpretive techniques are demonstrated. (See also W87-08365) (Halterman-PTT)
W87-08372

APPLICATION OF DATABASE MANAGEMENT TECHNIQUES TO RESERVOIR WATER QUALITY STUDIES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
B. G. E. Saul.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 83-91, 2 fig, 6 ref.

Descriptors: *Data management, *Data collection, *Data interpretation, Data processing, Water resources development, Water management, Resources management, Water quality control, Water quality, Resources development.

The general theory of database management systems, the Statistical Analysis System, and an application to a reservoir water quality sampling program are presented. The magnitude and diversity of data collected during water quality sampling programs often preclude the use of manual methods of storage and analysis. Therefore, a critical phase in the planning and operation of such programs is the establishment of a comprehensive database management system, the objective of which is to establish a protocol that encompasses data acquisition, maintenance, and utilization, while providing data consistency, validation, storage, and analysis. The Statistical Analysis System was selected as the operational component of a database management system applied to a reservoir research program because of its data management capabilities, numerous statistical procedures, and ease of use. (See also W87-08365) (Author's abstract)
W87-08374

ONE AND TWO DIMENSIONAL WATER QUALITY MODELING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5G.
W87-08375

DISTRICT CONSIDERATIONS IN MATH MODELING,
Corps of Engineers, Huntington, WV. Huntington District.
R. W. Punnett.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 114-118.

Descriptors: *Model studies, *Mathematical models, *Water resources development, Water management, Water quality control, Water quality, Resources development, Environmental effects.

Guidance for proper selection of math models for application at the Corps of Engineers District level is provided. Considerations necessary to properly select models for specific projects include knowing model limitations, help availability, system availability, and data availability. The relative times required to perform various aspects of modeling are discussed; data collection and preparation requires 70%, debugging requires 20%, and calibration requires 10% of the modeling effort. Recourses available to the modeler, if special needs arise after the model is developed, include: model conversion, source modification, and personal modification. (See also W87-08365) (Halterman-PTT)
W87-08377

MANAGEMENT INFORMATION SYSTEMS FOR WATER RESOURCES,
North Carolina State Univ. at Raleigh.
For primary bibliographic entry see Field 10D.
W87-08455

MATHEMATICAL AND STATISTICAL METHODS IN MODELING THE SEVESO DIOXIN EPISODE,
Pavia Univ. (Italy). Dept. of Nuclear Theoretical Physics.
For primary bibliographic entry see Field 5B.
W87-08489

STUDIES ON THE BACILLUS-POPULATION OF THE NW LITTORAL ZONE OF THE LAKE BALATON (HUNGARY),
Eoetvoes Lorand Univ., Budapest (Hungary). Dept. of Microbiology.
For primary bibliographic entry see Field 2H.
W87-08511

FUNCTIONAL BOX-COUNTING AND MULTIPLE ELLIPTICAL DIMENSIONS IN RAIN,
Meteorologie Nationale, Paris (France).
For primary bibliographic entry see Field 2B.
W87-08539

STOCHASTIC ANALYSIS OF DEPENDABLE HYDROPOWER CAPACITY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, D. G. Fontane, G. Q. Tabios, and N. F. Chou.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 113, No. 3, p 422-437, May 1987. 14 fig, 1 tab, 12 ref. Western Area Power Administration Contract DE-AC65-84WP58207.

Descriptors: *Data interpretation, *Indexed sequential modeling, *Model studies, *Hydropower capacity, Probabilistic process, Reservoirs, Simulation, Comparison studies.

Indexed sequential modeling (ISM) has been proposed by the Western Area Power Administration as an alternative approach to developing firm marketable capacity, i.e., project-dependable hydropower capacity (PDC), in contrast with the usual approach of basing PDC on the most adverse period of record. ISM allows a probabilistic analysis of hydropower capacity by extracting a series of overlapping short-term (say, 10 year) inflow sequenced directly from the historical record, which includes the most adverse period, and then simulating reservoir operations over this interval for each sequence. As a means of evaluating ISM, the New Melones Reservoir system in the federal Central Valley Project of California was selected as a case study for comparing hydropower output generated from ISM input with use of a multivariate stochastic inflow generation model. A comparison of monthly power and energy output at 95% confidence limits, 10% risk level, and most adverse, showed reasonably good correspondence between the two methods, except for a few months of energy production in the final year of simulation. (Author's abstract)
W87-08598

8. ENGINEERING WORKS

SUSCEPTIBILITY OF BROOK TROUT (SALVELINUS FONTINALIS) FRY TO A LIQUID FORMULATION OF BACILLUS THURINGIENSIS SEROVAR. ISRAELENSIS (TEKNAR (R)) USED FOR BLACKFLY CONTROL,
Quebec Univ., Trois-Rivieres. Groupe de Recherche sur les Insectes.
For primary bibliographic entry see Field 5C.
W87-07888

8A. Structures

ROLLER COMPACTED CONCRETE DAMS WORLDWIDE,
Portland Cement Association, Denver, CO.
K. D. Hansen.
International Water Power and Dam Construction IWPCDM, Handbook, p 27-31, 1987. 3 tab, 18 ref.

Descriptors: *Concrete dams, *Roller compacted concrete, *Construction methods, Dams, Wilson Creek dam, Shimajigawa dam, Gravity dams, Concretes.

Roller compacted concrete (r.c.c.) dams are gaining wide acceptance throughout the world. Since the completion of Shimajigawa dam in Japan and Willow Creek dam in the USA in 1982, 13 dams, more than 15 m(50 ft) high, have now been completed using this new construction method to produce a concrete gravity dam. Seven of these were completed in 1986. Eight additional r.c.c. dams are under construction or contract. Table I gives the main data for these structures. At least 10 more r.c.c. dams are now at the final design. (Author's abstract)
W87-07623

INDUSTRIAL DESIGNS OF LOW-HEAD ARCH AND MULTIPLE-ARCH DAMS ON A WEAK FOUNDATION,
N. P. Rozanov, G. M. Kaganov, I. M. Evdokimova, and V. B. Adesman.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 457-461, August 1986. 3 fig, 1 tab, 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 15-18, August 1986.

Descriptors: *Arch dams, *Dam design, *Dam construction, Earth dams, Cost analysis, Foundation failure, Model studies.

This study proposes designs of arch and multiple arch dams on weak foundations for narrow (up to 30-40 m) and wide (more than 30-40 m) sites. The arch dam allows using light, compact designs of outlets of the flume, siphon, and other types, the cost of which is substantially less than the cost of the outlet works for earth dams. Arch dams can also be constructed in a very short time (2-3 months), rendering construction possible in a low-flow period and minimizing diversion requirements. Two- and three- dimensional models indicate than when the bearing capacity of the dams is brought to the failure point, it is the failure of the dam itself, and not the weak foundation, which occurs. (McFarlane-PTT)
W87-07835

SCIENTIFIC AND TECHNICAL PROGRESS IN THE DESIGN AND CONSTRUCTION OF EARTH DAMS,
For primary bibliographic entry see Field 8D.
W87-07836

VIBRATION TECHNIQUES IN THE CONSTRUCTION OF LARGE DAMS,
O. A. Savinov.
Hydrotechical Construction HYCOAR, Vol. 20, No. 8, p 468-472, August 1986. 10 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 23-27, August 1986.

Descriptors: *Vibrations, *Construction methods, *Construction materials, *Construction equipment, Concrete construction, Concrete dams, Concrete technology.

Vibration techniques provide an increase in labor productivity, a decrease in material expenditures, and radical changes in the basic principles of construction. Vibration techniques permit the following: (1) deep compaction of fluid and stiff (liquifying) concrete mixes; (2) deep hydraulic vibrocompaction of noncohesive saturated soils in natural foundations of hydraulic structures and in hydraulic fill; (3) surface compaction both of noncohesive and cohesive soils during their placement in the shoulders and cores of earth dams; (4) surface layer-by-layer compaction of especially stiff (nonliquifying) concrete mixes, soil concretes, and asphaltic concretes; (5) molding of concrete and reinforced concrete precast elements and uniform fragments of mass structures; and (6) performance of difficult and labor-intensive technological operations related to the construction of large dams. (McFarlane-PTT)
W87-07837

USE OF INTENSIVE IMPACT COMPACTION OF SOILS IN THE CONSTRUCTION OF DAMS AND EMBANKMENTS,
For primary bibliographic entry see Field 8D.
W87-07838

ANDEKALELA WATER INTAKE CHARACTERISTICS FOR EXCLUDING SEDIMENTS (CARACTERISTIQUES DE LA PRISE D'EAU A ANDEKALELA POUR L'EXCLUSION DES SEDIMENTS),
La Salle Ltd. (Quebec). Lab. d'Hydraulique.
F. E. Parkinson, J. L. Gordon, and B. Rakotondrafara.
La Houille Blanche, No. 6, p 441-449, 1986. 15 fig, 1 ref.

Descriptors: *Sediment transport, *Hydroelectric power production, *Bed load, *Intakes, *Sediments, *Model studies, Performance evaluation, Diversion dams, Madagascar.

The Andekaleka hydroelectric project on the Vohitra River in Madagascar (head: 214 m, 56 MW) began operation in 1982. The works include an intake designed to exclude bedload from entering the water passages. Topographic restrictions at the site required a design with only a nominal increase in headwater level, and did not permit the use of normal sediment settling basins. Scale hydraulic model studies suggested modifications to the preliminary design, which were developed around a collecting-tube intake integrated into the overflow spillway structure. A submerged concrete wall divides the head-pond into two parts, and diverts the bedload toward two large spillway sector gates for clearing during flood flows. Field inspections after two years' operation confirmed the model forecasts in terms of water flow and sediment transport. (Author's abstract)
W87-08279

UPDATE ON DREDGING ACTIVITIES IN THE PACIFIC NORTHWEST,
Army Engineer Div. North Pacific, Portland, OR.
For primary bibliographic entry see Field 6G.
W87-08381

WATER QUALITY MANAGEMENT AT HARRY S. TRUMAN DAM AND RESERVOIR,
Corps of Engineers, Kansas City, MO. Kansas City District.
For primary bibliographic entry see Field 5G.
W87-08390

NONLINEAR HYDRODYNAMIC PRESSURE ON RIGID DAM MOTION,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-08540

GROUT CURTAIN IN THE FOUNDATION OF THE NUREK DAM AND EVALUATION OF ITS EFFECTIVENESS,
I. S. Ronzhin, L. E. Kanygin, V. N. Chernenko, P. P. Listrovoi, and F. G. Kim.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 539-542, September 1986. 3 fig, 2 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 18-21, September 1986.

Descriptors: *Dams, *Hydraulic structures, *Grouting, *Grout curtains, *Nurek Dam, *Dam foundation, *USSR, Evaluation, Seepage, Seepage control, Design criteria, Mathematical equations.

General problems of seepage in the body of the Nurek Dam have been recorded since the beginning of the construction of the dam in 1971. The effectiveness of the grout curtain, which is the main cutoff element in the foundation of the dam, were analyzed. The design of the grout curtain was reviewed and its current condition was studied. It was concluded that the grout curtain constructed in the foundation rocks of the dam to a depth of as much as 140 meters achieved the design density over the entire front. The results of on-site observation of the work of the curtain indicated no degradation with time. The high values of reduction of the seepage head on the stretch before the curtain in the foundation of the central part of the dam support the suggestion that the number of rows and the spacing between holes be reduced when constructing grout curtains under analogous engineering-geological conditions. (Wood-PTT)
W87-08573

CHARACTERISTICS OF TEMPORARY STREAMFLOW DIVERSION AND DAMMING RIVER CHANNELS UNDER MOUNTAIN CONDITIONS,
For primary bibliographic entry see Field 2E.
W87-08574

ON-SITE OBSERVATIONS OF THE KASSEB ARCH DAM,
I. F. Blinov, and E. M. Mirzak.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 552-558, September 1986. 5 fig, 3 tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 36-41, September 1986.

Descriptors: *Arch dams, *Dasseb arch dam, *Data interpretation, *Dams, Dam design, Dam foundations, Dam stability, Tunisia, Monitoring, Data collections, Concrete testing, Compressibility.

The Kasseb arch dam was constructed in Tunisia on the Kasseb River-Medjerda River according to the design of the All-Union Planning, Surveying, and Scientific-Research Institute during 1967-1969. Descriptions are provided of the local geology, local precipitation, and of the dam itself. The monitoring equipment installed in the dam checked the safe operation of the structure and collected data on the degree of correspondence of the state of the dam to the design assumptions. During the operation period from 1969 to 1984, 86% of the total number of embedded sensors operated satisfactorily. Of the piezometric apparatus, 50% of the piezometers in the left-bank and 75% of the ones in the right-bank operated satisfactorily. An analysis of the long-term observations showed that the temperature regime of the dam concrete can be considered quasi-steady, that under full hydrostatic load the joints of the arch part of the dam are compressed, that the maximum value of displacements of the crest of the crown section coincided satisfactorily with the calculations, that under the full head the dam concrete was compressed, and that the seepage regime in the dam foundation and bank abutments has a steady character. (Wood-PTT)
W87-08576

8B. Hydraulics

METHODS FOR DETERMINING THE MECHANICAL INTEGRITY OF CLASS II INJECTION WELLS,
Robert S. Kerr Environmental Research Lab., Ada, OK. Ground Water Research Branch.
D. M. Nielsen, and L. Aller.
Available from the National Water Well Association, 500 W. Wilson Bridge Road, Worthington, Ohio. 43085. Report No. EPA-600/2-84-121, July 1984. 262 p, 99 fig, 21 tab, 100 ref, 2 append. EPA Cooperative Agreement CR-809353.

Descriptors: *Underground waste disposal, *Dakota Aquifer, *Injection wells, *Performance evaluation, *Mechanical failure, Hydrocarbons, Monitoring, Hydraulic structures, Boreholes, Radioactivity.

The Underground Injection Control program regulations, administered by the U.S. Environmental Protection Agency, require injection well operators to test the mechanical integrity of injection wells, including those wells that inject fluids: (1) brought to the surface during oil and gas production; (2) for enhanced recovery of oil and gas; and (3) for storage of hydrocarbons in the subsurface (Class II wells). Testing is required to satisfy the regulatory requirement that there is no significant leak in the casing, tubing or packer, and that there is no significant fluid movement through vertical channels adjacent to the injection well. There are a number of methods available to injection well operators for mechanical integrity testing. These include monitoring of annulus pressure, pressure testing, temperature logging, noise logging, pipe analysis surveys, electromagnetic thickness surveys, caliper logging, borehole television, borehole televiewer, flowmeter surveys, radioactive tracer surveys and cement bond logging. Only temperature logging, noise logging and radioactive tracer surveys can be utilized to provide relatively definitive information regarding the presence or absence of fluid movement behind casing; cement bond logs provide information from which fluid movement may be inferred. With the exception of cement bond logging, all of the testing methods can be used to locate leaks in casing. This document describes each of the methods that can be used in mechanical integrity testing in detail, including the principles, equipment, procedures, interpretation, cost, advantages and disadvantages and examples of each technique. Other methods which may also have application in mechanical integrity testing, but which require additional field testing to establish their effectiveness, are also described. Many of the described mechanical integrity tests are not adaptable to the testing of hydrocarbon storage well systems. During the last few years, rapid development of specialized testing procedures has changed the state of the art considerably. Therefore, a discussion of storage well testing methods is not included in this document. (Author's abstract)
W87-07783

HIGH-ENERGY NEARSHORE PROCESSES,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 2J.
W87-07804

DEVELOPMENT OF MATHEMATICAL METHODS OF INVESTIGATING TRANSIENTS IN SURGE TANKS OF HYDROELECTRIC STATIONS,
O. A. Murav'ev.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 479-483, August 1986. 6 fig, 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 31-34, August 1986.

Descriptors: *Mathematical studies, *Hydroelectric plants, *Hydroelectric power, *Hydrodynamics, *Surge tanks, Flow characteristics, Fluid mechanics.

Hydrostations with surge tanks generally have a branched system of penstocks feeding several turbines from one diversion conduit. The maximum rise of the level in the tank is determined on the basis of the transient regime of the simultaneous dumping of the maximum power by all turbine generator units hydraulically connected by a common diversion conduit. The minimum level in the tank is determined by the emergency increase of the load either by one unit or, in the case of a large number of units, by the last two units with the remaining ones operating at full load. Thus the possibility of simultaneous maneuvering of the hydrostation units in a wide range of powers is precluded. This study examined the general regularities characteristics of the oscillatory process during successive changes in the discharge of units having a common diversion conduit. Conclusions were: (1) an analysis of successive combinations of transients makes it possible to increase the speed and reliability of the operation of hydrostations with surge tanks in the case of emergency situations in the power system. (2) At operating hydrostations with surge tanks and branched penstocks, a programmed regime of increase of load in several phases permits building up the full power of all units of the hydrostations in a minimum time interval while providing permissible oscillations of the level in the tank. (3) When designing surge tanks it is advisable to assign the minimum elevation of the level in them from conditions of providing the sumultaneous start-up and increase of the load for all units of the hydrostation, which permits maximum use of their maneuvering possibilities. (4) For hydrostations at which the simultaneous start-up and increase of load by units with a common

diversion conduit is possible, a check of the operation of the tank for dumping of the load after its full increase for the most favorable lag time should be accomplished on mathematical models; for the combination 'increase of load after dumping' a lag time which provides a drop of the level in the tank not below the elevation corresponding to the design increase of load is calculated and introduced into the technological automation system. (McFarlane-PTT)
W87-07839

HYDRAULIC JUMPS AT POSITIVE AND NEGATIVE STEPS,
Ecole Polytechnique Federale de Lausanne (Switzerland).
W. H. Hager, and N. V. Bretz.
Journal of Hydraulic Research JHYRAF, Vol. 24, No. 4, p 237-253, 1986. 14 fig, 15 ref, append.

Descriptors: *Hydraulic jump, *Fluid mechanics, *Hydraulics, *Stilling basins, Hydraulic design, Basins, Design criteria, Froude number, Mathematical equations, Mathematical studies, Waves, Comparison studies.

The hydraulic flow features associated with a hydraulic jump over positive and negative steps are investigated. Attention is paid to the extreme positions of the phenomena, which allow the design of the stilling basin. In particular, the sequent depths ratio, the length characteristics, and wave formation are analyzed by elementary means and confirmed by observations. A comparison of the two energy dissipators clearly focuses the respective advantages. A negative step was found to have an approximately six times higher flexibility of tailwater depth variation. The minimum B-jump corresponded to the jump of highest efficiency, provided 3 < Froude number (F1) < 8. For higher F1, the dissipation of all hydraulic jumps was approximately equal and corresponded to the value as given for the hydraulic jump in a horizontal channel. The hydraulic jump at a positive step was shown to be more compact than at a negative step. (Wood-PTT)
W87-07862

CONCENTRATION OF VERY FINE SILTS IN A STEADY VORTEX,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2J.
W87-07863

VORTEX FORMATION IN THE MIXING LAYER BEHIND DUNES,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Wasserwirtschaft.
For primary bibliographic entry see Field 2J.
W87-07865

NUMERICAL SIMULATION OF FLOODING AND DRYING IN A DEPTH-AVERAGED TIDAL FLOW MODEL,
Bradford Univ. (England). Dept. of Civil Engineering and Structural Engineering.
For primary bibliographic entry see Field 2L.
W87-08076

ESTIMATION OF DILUTION IN BUOYANT EFFLUENTS DISCHARGED INTO A CURRENT,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
For primary bibliographic entry see Field 5E.
W87-08077

SEA WATER INTRUSION AND PURGING IN MULTI-PORT SEA OUTFALLS,
J. A. Charlton, P. A. Davies, and G. H. M. Bethune.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 83, Part 2, p 263-274, March 1987. 11 fig, 10 ref, append. SERC Grants GR/C/05274 and GR/C/05236.

Descriptors: *Saline water intrusion, *Outfall sewers, *Hydrodynamics, *Purging, Monitoring, Seawater, Estimating, Hydraulics.

The mechanism of sea water intrusion is discussed and its primary and secondary phases delineated. Conditions for the purging of affected outfalls are considered for invert- and soffit-connected cases, and the heads required to achieve fully purged states for the two cases are estimated. The implications of the hydraulic behavior of the outfall for the effective detection and monitoring of intrusion are discussed, and the preliminary results of laboratory-based verification tests are described. (Author's abstract)
W87-08079

BEHAVIOUR OF TURBULENT WATER JETS IN THE ATMOSPHERE AND IN PLUNGE POOLS,
Glasgow Univ. (Scotland). Dept. of Civil Engineering.
D. A. Ervine, and H. T. Falvey.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 83, Part 2, p 295-314, March 1987. 13 fig, 2 tab, 14 ref, append.

Descriptors: *Hydrodynamics, *Jets, *Discharge, *Turbulent flow, *Atmosphere, *Plunge pools, Diffusion, Entrainment, Pressure, Shear.

Measurements made on a free water jet discharging almost horizontally are described; from these, the authors conjecture the fundamental nature of free turbulent jets plunging through the atmosphere and diffusing in the plunge pool. Consideration of jet diffusion in the plunge pool includes a comparison between submerged jet and impinging jet diffusion, the role of inner core decay for impinging jets in a pool, the effect of entrained air on the reduction of impact pressures, and an analysis of the pressure fluctuations caused by turbulence in the plunge pool shear layers. (Author's abstract)
W87-08080

TURBIDITY CURRENTS AND SUBMARINE CHANNEL FORMATION IN RUPERT INLET, BRITISH COLUMBIA: 2. THE ROLES OF CONTINUOUS AND SURGE-TYPE FLOW,
Memorial Univ. of Newfoundland, St. John's. Dept. of Physics.
A. E. Hay.
Journal of Geophysical Research (C) JGRCEY, Vol. 92, No. 3, p 2883-2900, March 1987. 9 fig, 4 tab, 30 ref, 2 append. NSERC (Canada) Grants A8446 and G0208.

Descriptors: *Sediment transport, *Density currents, *Turbidity currents, *Submarine canyons, *Turbidity, *Hydrodynamics, *Submarine channels, *Rupert Inlet, *Currents, *Acoustic backscatter, *Mine wastes, *Model studies, Sediments, Discharge, Transport, Flow, Surges, Waves.

Acoustic backscatter images are presented of the continuous flow turbidity current resulting from mine tailing discharge into Rupert Inlet. The current flows partially within a submarine channel, which both hooks to the left and meanders. The images show the turbidity current spilling over the outer levees at channel bends. A model for continuous turbidity flow incorporating overspill is developed and applied to the left-hooking section of the submarine channel. It is very likely that the observed overspill is primarily an inertial effect resulting from the outer bank being more sharply curved than the channel axis. The model results are combined with a sediment accumulation budget based on successive seismic profiling surveys and with results for surge-type flows. It shows that surges are primarily responsible for the transport of tailing to large distances from the point of discharge and should recur at 1- to 2-day intervals on average. This is consistent with the characteristics of coarse-grained turbidities observed in cores from the levees. Relative to the intervening fine-grained mud deposits the turbidities increase both in thickness and frequency in the downchannel direction. Furthermore, the surge recurrence interval obtained from the number of turbidities per core and the local accumulation rate is 2-5 days, essentially the same as that obtained from the model. Suspended tailing transport within the channel appears to be dominated by surge-type turbidity currents except close to the outfall. It is concluded that the surge-type flows are most responsible for the formation and morphology of much of the channel. It is not clear, however, that the meanders are formed principally by surges. Although the surges occur frequently and transport most of the sediment in the meander reach, the volume transport is dominated by continuous flow. (See also W87-08091) (Author's abstract)
W87-08092

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART I: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-08229

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART II: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-08230

ACOP CANALS EQUILIBRIUM DATA: VOLUME IX - PART III: COMBINED 1979-1980 DATA,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-08231

BEDFORM-GENERATED CONVECTIVE TRANSPORT IN BOTTOM SEDIMENT,
Louisiana State Univ., Baton Rouge. Hazardous Waste Research Center.
For primary bibliographic entry see Field 5B.
W87-08254

EXPERIMENTAL AND THEORETICAL ANALYSIS OF FLOW IN A MIXED FLOW IMPELLER (MESURES ET ANALYSES DE L'ECOULEMENT DANS UNE ROUE DE POMPE MIXTE),
Societe pour la Mesure et le Traitement des Milieux Fluides, Lyon (France).
J. M. Duchemin, I. Trebinjac, and E. Rieutord.
La Houille Blanche, No. 6, p 457-462, 1986. 11 fig, 7 ref.

Descriptors: *Pumps, *Hydrodynamics, *Hydraulic models, *Impellers, *Design criteria, *Hydraulic geometry, Mathematical analysis, Theoretical analysis, Lasers, Comparison studies, Design flow.

Experimental investigation of the flow downstream of a mixed-flow pump impeller has been made (in water), with a five-hole probe and a laser doppler velocimeter. An attempt to predict measured losses with a simple method based on classical axial flow compressor knowledge has been made. Furthermore, because of the pump's geometry, it was necessary to evaluate curvature and rotation effects on boundary layer growth. The Balje approach has been used for this case. Comparisons between theoretical and experimental results of another mixed flow impeller tested in air are added. (Author's abstract)
W87-08281

COASTAL UPWELLING ON A SLOPING BOTTOM: THE FORMATION OF PLUMES, JETS AND PINCHED-OFF CYCLONES,
University of Southern California, Los Angeles. Dept. of Mechanical Engineering.
S. Narimousa, and T. Maxworthy.
Journal of Fluid Mechanics JFLSA7, Vol. 176, p

169-190, March 1987. 14 fig, 34 ref. NSF Grant OCE-8214549.

Descriptors: *Coastal upwelling, *Plumes, *Jets, *Cyclones, *Hydrodynamics, *Model studies, *Waves, Velocity, Fronts, Upwelling, Flow field, Fluid mechanics.

An experimental, two-layer, stratified model of coastal upwelling was produced at the outer edge of a cylindrical tank having a conical bottom. Most of the characteristics of the flow field can be described by the single non-dimensional parameter theta sub * = g'h sub O/u sub * f(lambda sub s) (where g' = g(delta)rho is the reduced gravity, h sub O is the initial depth of the top layer, u sub * is the friction velocity applied to the top surface of the fluid, f is the Coriolis parameter and lambda sub s is the distance of the stationary position of the upwelling front at the surface from the wall of the tank). The migration rate of the front at the surface, u sub f is given by u sub f/u sub * approx. = square root of theta sub *. The size lambda sub w of the frontal, circular waves is lambda sub w/ lambda sub s approx. = theta sub *. These waves first appear at the front when it has moved a distance lambda sub i < lambda sub s given by lambda sub i/lambda sub s approx. = square root of theta sub * and have a final drift velocity u sub w = 0.5 U in the direction of the applied stress (where U is the mean velocity of the top layer). At low values of theta sub * complex interactions between the growing waves create intense meandering jets which transport upwelled fluid far from the mean position of the front. (Author's abstract)
W87-08316

EFFLUX FROM A SLIT IN A VERTICAL WALL,
Adelaide Univ. (Australia). Dept. of Applied Mathematics.
E. O. Tuck.
Journal of Fluid Mechanics JFLSA7, Vol. 176, p 253-264, March 1987. 9 fig, 12 ref.

Descriptors: *Hydrodynamics, *Efflux, *Slits, *Numerical analysis, *Falling water, Froude number, Volume flux, Stagnation point, Flow, Gravity.

A numerical solution is provided for flow of a stream of water falling under gravity after emerging from a simple slit orifice in a vertical wall. The classical free-streamline flow with contraction coefficient 0.611 applies in the absence of gravity, or as F approaches infinity, where F is the Froude number based on the net volume flux and the slit width. We assume here that F is finite, but find that the flow exists only for F > or = 0.496, with initial backflow at the upper stream surface for 0.496 < or = F < or = 0.578. The limiting flow at F = 0.496 has a stagnation point at the upper edge. (Author's abstract)
W87-08317

WEIR FLOWS,
Wisconsin Univ.-Madison. Dept. of Mathematics.
J.-M. Vanden-Broeck, and J. B. Keller.
Journal of Fluid Mechanics JFLSA7, Vol. 176, p 283-293, March 1987. 9 fig, 10 ref. US Army Contract DAAG 29-80-C-0041 and NSF Grant MCS-8001960.

Descriptors: *Weir flow, *Numerical analysis, *Stream gaging, *Gaging, *Hydrodynamics, *Weirs, *Channels, Flow, Depth, Velocity, Mathematical equations.

The flow of a liquid with a free surface over a weir in a channel is calculated numerically for thin weirs in channels of various depths, and for broad-crested weirs in channels of infinite depth. The results show that the upstream velocity, as well as the entire flow, are determined by the height of the free surface far upstream and by the geometry of the weir and channel, in agreement with observation. The discharge coefficient is computed for a thin weir, and a formula for it is given that applies when the height of the weir is large compared to the height of the upstream free surface above the top of the weir. The coefficients in this formula are close to those found empirically. (Author's abstract)
W87-08318

NONLINEAR HYDRODYNAMIC PRESSURE ON RIGID DAM MOTION,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
T. K. Hung, and M. H. Wang.
Journal of Engineering Mechanics JENMDT, Vol. 113, No. 4, p 482-499, April 1987. 12 fig, 1 tab, 28 ref. NSF Grant ECE-8414649.

Descriptors: *Dam design, *Compressibility, *Stress, *Finite difference analysis, *Dams, *Hydrodynamics, Earthquakes, Mathematical analysis, Boundary conditions, Model studies.

A finite-difference analysis was employed to calculate nonlinear hydrodynamic pressures on vertical and inclined faces of dams. Two idealized ground accelerations and an actual earthquake excitation were used as the prescribed boundary conditions. This dynamic condition and the free surface profile were cast in a dimensionless form of the basic equations, making the moving boundary problem simpler in computational analysis. The effect of water compressibility could be augmented by the nonlinear effect. Comparison of the results between inviscid and viscous analyses reflected not only the insignificant viscous effect but also the potential numerical noise associated with the viscous solution. (Author's abstract)
W87-08540

FLOW OVER SHARP-CRESTED PLATE WEIRS,
Concordia Univ., Loyola Campus, Montreal (Quebec). Dept. of Engineering.
For primary bibliographic entry see Field 7B.
W87-08581

8C. Hydraulic Machinery

SMALL SCALE HYDRO DEVELOPMENT FOR REMOTE AREAS,
K. Goldsmith.
International Water Power and Dam Construction IWPCDM, Handbook, p 17-21, 1987.

Descriptors: *Hydroelectric power development, *Rural areas, *Electric power production, *Economic aspects, Hydropower resources, Electricity, Networks, Growth.

The development of local hydropower resources in rural areas can offer an attractive alternative to diesel generation, and also the possibility of extending existing networks to remote areas. It can provide electricity to locations where no commercial energy was available, consequently stimulating the growth of the local economy. (Author's abstract)
W87-07621

PREFABRICATED POWERPLANT REDUCES CIVIL WORKS,
Societe Grenobloise d'Etudes et d'Applications Hydrauliques (France).
F. R. Ferrer-Laloe.
International Water Power and Dam Construction IWPCDM, Handbook, p 23-25, 1987.

Descriptors: *Prefabricated power plants, *Engineering, *Electric power production, France, United States, Civil engineering.

Designing and building the receiving structures for the prefabricated W. T. Love generating station in the USA involved innovative engineering, and the use of several unusual techniques. The 70 MW powerplant was assembled in a French shipyard, shipped across the Atlantic, and finally towed up the Mississippi and Ohio rivers to its destination. (Author's abstract)
W87-07622

SOVIET HYDROPOWER: ACHIEVEMENTS AND PROSPECTS,
Hydrometeorology Scientific Research Center, Moscow (USSR).
L. Mikhailov.
International Water Power and Dam Construction IWPCDM, Handbook, p 33-35, 1987.

Descriptors: *Hydropower development, *USSR, *Electric power production, Pumped storage plants, Siberia, Russia, Construction projects.

Soviet hydro potential has been estimated at 1095 TWh, of which only about 19 per cent has so far been exploited. This article looks at some of the major schemes which have been commissioned, or on which work has begun, in the past year, and also discusses long-term plans. In the European part of the country emphasis will be on pumped-storage plants, whereas in Siberia, the Far East and Central Asia a number of massive hydro schemes are to be constructed. (Author's abstract)
W87-07624

COMMON FLAWS IN SMALL HYDRO PLANTS,
W. I. Pentin.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 4, p 14-17, April 1987.

Descriptors: *Design standards, *Electric power production, *Engineering, *Hydroelectric power plants, *Flaws, United States, Construction, Costs, Specifications, Estimating.

Inappropriate specifications, inadequate designs, deficiencies in machinery, or the mistaken impression that small hydro requires less engineering than a large scheme have all led to a number of problems in the design and construction of small hydro plants; energy available can be over-estimated and costs under-estimated, for example. The author presents a personal critique of common problems in small hydro plants, based on his extensive experience with schemes in the USA. (Author's abstract)
W87-07627

EQUIPMENT FOR SMALL HYDRO SCHEMES: A REVIEW OF PROGRESS,
Leyland Consultants Ltd., Auckland (New Zealand).
B. W. Leyland.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 4, p 20-24, April 1987. 7 fig, 19 ref.

Descriptors: *Hydroelectric power plants, *Hydraulic equipment, *Reviews, *Hydroelectric technology, *Costs, Mechanical equipment, Electrical equipment, Engineering, Design, Turbines.

The state-of-the-art of small hydro technology is far from perfection. For small hydro to make its rightful contribution to reducing dependence on imported oil and to provide an economical and reliable supply of power to rural communities, a whole-hearted commitment to appropriate technology is essential. Mechanical and electrical equipment for small hydro schemes cannot be mass produced; it must be individually designed to overcome the unique problems of each site and to optimize the available potential. Unfortunately, worldwide, there are few engineers with the necessary experience and there is a need for good reference books and expert systems for computer aided design. Turbine technology is mature, and many of the newly designed turbines are a solution in search of a problem because they seldom have substantial advantages over traditional turbines. Small hydro does indeed put a new challenge to consultants and they must rise to meet it or see the interest in small hydro fade as quickly as it has arisen. Small hydro also puts a fascinating challenge to its designers; in what other branch of engineering does the engineer have such a wide range of options, so few restrictions on innovative ideas, not many established precedents and the opportunity for a small group to conceive, design and commission their own unique project. (Alexander-PTT)
W87-07628

FINANCIAL ANALYSIS OF SMALL HYDRO STATIONS IN CHINA,
Zhengzhou Inst. of Tech. (China).
C. Shui-xin.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 4, p 46-49, April 1987. 4 fig, 3 tab.

Descriptors: *Mathematical equations, *Financial feasibility, *Hydroelectric power production, *China, *Economic aspects, Energy, Financing, Costs, Equations, Electric power production.

A series of simplified formulae are established to assess the financial feasibility of planned small hydropower projects in China. An unusual economic indicator, the annual energy per unit investment, is introduced, and 45 small stations are analyzed in the light of this indicator and the derived formulae. (Author's abstract)
W87-07629

ASCENDANCY OF THE PUMP CONTRACTOR,
A. Crow.
Water Well Journal WWJOA9, Vol. 41, No. 2, p 24-25, February 1987.

Descriptors: *Drilling, *Pumps, *Contractors diversification, Water treatment equipments, Service contracts, Maintenance contract, Filters.

As the number of new wells drilled are declining so is the business of drillers. Since the cost of drilling equipments are high it is difficult to start a new drilling business. Income from a new business is not good. In the present setup the only source of income of a drilling contractor is the drilling of new wells. But the potential income of a pump contractor is very good. This is primarily due to his ability and willingness to get involved into areas other then pump installation, such as, pump servicing and maintenance of pumps, filters and other water treatment and conditioning equipments. Unless the drillers change their atitudes and mode of operation their chances of survival, according to the author, is small. (Ray-PTT)
W87-07793

NEW POWER ON THE OHIO RIVER,
For primary bibliographic entry see Field 6C.
W87-07832

DEVELOPMENT OF MATHEMATICAL METHODS OF INVESTIGATING TRANSIENTS IN SURGE TANKS OF HYDROELECTRIC STATIONS,
For primary bibliographic entry see Field 8B.
W87-07839

USE OF NEW ANTIFRICTION MATERIALS IN HEAVILY LOADED THRUST BEARINGS OF TURBINE-GENERATOR UNITS,
A. E. Aleksandrov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 491-493. 1 tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 39-40, August 1986.

Descriptors: *Bearings, *Fluoroplastics, *Turbines, *Materials engineering, Materials testing, Maintenance, Electrical equipment.

One of the most essential components of a turbine-generator is the thrust bearing, at which separation of the rotating and stationary parts occurs. In large vertical units the bearing absorbs an enormous load, determined by the weight of the rotating parts and the water pressure on the turbine runner. The problem of creating reliable thrust bearings for high total and unit loads was solved by replacing traditional babbitt-coated segments with elastic metal-plastic segments lined with fluoroplastic. These segments are withstanding unit loads of 7 MPa without restrictions with respect to operating conditions and without the use of a forced lubrication system during starts. The yielding of the elastic metal-plastic segments makes it possible to markedly reduce local contact stresses on the friction surface and to provide a uniform load over the entire area of the segment during starts. (McFarlane-PTT)
W87-07841

PURNER PUMP PULLER,
G. J. Swanson.
Water Well Journal WWJOA9, Vol. 41, No. 3, p 51-52, March 1987.

Descriptors: *Tools, *Equipment, *Purner Pump Puller, *Hydraulic machinery, *Hydraulic equipment, *Pumps, *Pump wells, Chesapeake Bay, Maintenance, Bacteria.

The Purner Pump Puller (PPP) is used by the Purner and Sons Well Drilling company in the Chesapeake Bay area to remove deep-set submersible or jet pumps from wells. The invention is described and its advantages cited. The PPP requires no electricity and only one person to operate it. It can be wheeled on and off a truck or trailer to any remote well location and is hand-operated which allows the operator to feel the pump catching on an obstruction in the well casing and to stop the drum before something breaks. The PPP requires little maintenance. Most importantly, the PPP fosters sanitary conditions by eliminating the need to place the plastic coil pipes attached to deep-set submersible pumps on the muddy ground where they picked up dirt, debris and bacteria prior to replacement in the well. There are no plans for full-scale manufacture of the PPP. (Wood-PTT)
W87-07861

AIR DRIVE ROTATING BIOLOGICAL CONTACTORS - PROBLEMS ENCOUNTERED AND SOLUTIONS SOUGHT: PART II,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-07869

MANUAL FOR HIGHWAY STORM WATER PUMPING STATIONS: VOLUME 1.
Lever (William F.) and Associates, Long Beach, CA.
Available from the National Technical Information Service, Springfield, Virginia 22161, as PB84-152727. Price codes: A18 in paper copy; and A01 in microfiche. Department of Transportation Report No. FHWA-IP-82-17-Vol. I, October 1982. Final Report. 392 p, 226 fig.

Descriptors: *Design standards, *Pumping plants, *Storm water, *Highways, Roads, Hydraulic machinery, Cost analysis, Storm runoff, Drainage.

The purpose of this manual is provide a comprehensive source of design information on storm water pumping stations for highway facilities. However, users are cautioned to use proper engineering judgement and must themselves be entirely responsible for any interpretations and applications of the data and opinions set forth. An initial field survey was conducted to determine the present practices and experiences in several States, which proved to be extremely varied, with some basic differences in design concepts. All States were invited to submit information on their installations and most did so. Some of the data presented have been taken from these submittals, and some from relevant literature. Some have been drawn from manufacturers' catalogs. Examples from actual pumping stations have been incorporated whenever possible, by reproducing photographs or construction drawings in simplified form. Various types of pumping stations are discussed in the early chapters, with guidance as to which might be expected to be most suitable for various conditions. Later chapters deal with station machinery and features, including electrical systems. (Author's abstract)
W87-08248

COMPUTERIZED MANAGEMENT OF FLUVIAL PLANTS WITH MULTIPLE AIMS: THE RHONE EXAMPLE (LA GESTION AUTOMATISEE D'AMENAGEMENTS FLUVIAUX A BUTS MULTIPLES: L'EXEMPLE DU RHONE),
Compagnie Nationale du Rhone, Lyon (France).
For primary bibliographic entry see Field 4A.
W87-08278

IMPROVEMENT OF PUMP PERFORMANCE AT OFF DESIGN CONDITIONS (AMELIORATION DES PERFORMANCES HORS ADAPTATION D'UNE POMPE AXIALE),
Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux (France).
J. Paulon, C. Fradin, and J. Poulain.
La Houille Blanche, No. 6, p 451-456, 1986. 11 fig, 3 ref.

Descriptors: *Pumps, *Design criteria, *Baffles, Performance evaluation, Pumping head, Mechanical equipment, Design flow, Hydraulic equipment.

Industrial pumps are generally used in a wide range of operating conditions from zero or almost zero mass flow to mass flows larger than the design value. It has often been noted that the head-mass flow characteristic of conventional axial flow pumps operating at constant speed presents a negative hump as the mass flow becomes somewhat smaller than the design mass flow. The pump does not stall, there are no real low frequency oscillations in the circuit, but flow and mechanical instabilities, unsafe for the facility, are present for some intermediate flow range. A joint experimental venture between ONERA and Alsthom/Rateau Division was undertaken in order to analyze and if possible to palliate these difficulties. Use of a diaphragm reduced the hump, but pump performance deteriorated as well. A baffle placed at the center of the recirculation zone reduced the hump and augmented pump performance as well at low-flow conditions. The tests were performed in air instead of water, keeping the same flow coefficients. (Airone-PTT)
W87-08280

EXPERIMENTAL AND THEORETICAL ANALYSIS OF FLOW IN A MIXED FLOW IMPELLER (MESURES ET ANALYSES DE L'ECOULEMENT DANS UNE ROUE DE POMPE MIXTE),
Societe pour la Mesure et le Traitement des Milieux Fluides, Lyon (France).
For primary bibliographic entry see Field 8B.
W87-08281

PERIODIC OPTIMAL CONTROL WITH APPLICATION TO PUMPED STORAGE PLANTS,
Israel Electric Corp. Ltd., Haifa.
D. Weiner.
Water Resources Research WRERAQ, Vol. 23, No. 4, p 535-541, April 1987. 7 fig, 17 ref.

Descriptors: *Electric powerplants, *Hydroelectric plants, *Algorithms, *Plant operations, *Pumped storage, *Pumping plants, *Optimization, Process control, Numerical analysis, Simulation.

This paper suggests how nonlinear periodic optimal control of a pumped storage plant can be realized. The control problem consists in maximization of the plant benefits over an operational period. An optimal control law is proposed, yielding a bang-off-bang mode of operation. An algorithm for numerical solution of the problem was developed, and its effectiveness was demonstrated by simulation experiments. (Author's abstract)
W87-08329

TURBINE VENTING AT CLARKS HILL DAM,
Army Engineer District, Savannah, GA.
G. V. Mauldin.
IN: Proceedings of a Seminar on Attaining Water Quality Goals through Water Management Procedures, February 17-18, 1982, Dallas, Texas. p 229-244, 8 fig, 4 ref.

Descriptors: *Water quality control, *Water management, Lakes, Reservoirs, Multipurpose reservoirs, Reservoir operation, Environmental effects, Water resources development, Dams.

A method of increasing the dissolved oxygen concentration of anoxic hypolimnetic waters released from the Clarks Hill Reservoir about 20 miles northwest of Augusta, Georgia, on the Savannah River, is discussed. The method described involves venting air into the draft tube below the hydropower turbine. Results of a field test indicated that the use of hub baffles in the turbines could reduce the number of days that the dissolved oxygen level was below 5 mg/l by 61%. Furthermore, dissolved oxygen levels above 4 mg/l could be maintained year-round with the turbine venting systems. Dissolved nitrogen uptake, power losses and costs are also discussed. (See also W87-08365) (Halterman-PTT)
W87-08389

PUMP-TURBINE PERFORMANCE TEST: MT. ELBERT PUMPED-STORAGE POWERPLANT AND FOREBAY DAM, UNIT 1 FRYINGPAN-ARKANSAS PROJECT, COLORADO; FLOW MEASUREMENT BY THE SALT VELOCITY METHOD.
Water and Power Resources Service, Denver, CO.
Report No. HM-24, December 1984, 59 p, 9 fig, 22 tab, 6 ref, 3 append.

Descriptors: *Performance evaluation, *Pump turbines, *Flow measurement, *Hydroelectric powerplants, Powerplants, Turbines, Pumps, Pumped storage, Dams, Hydraulic machinery.

In September 1982, a performance test was carried out on the vertical-shaft, single-impeller, pump-turbine Unit 1 at the Mt. Elbert Pumped-Storage Powerplant and Forebay Dam, Twin Lakes, Colorado. The operating characteristics were determined in the pump and turbine modes. Results of the test indicate the performance characteristics of the unit operating in the pump mode to be: 91.0% maximum efficiency at 2,997-cu-ft/sec discharge and 468-ft total head for a pump input of 174,300 horsepower. The performance characteristics of the unit operating in the turbine mode were: 94.17% maximum efficiency at 2m111-cu-ft/sec adjusted discharge at 448-ft-net head for an adjusted turbine output of 148,500 horsepower. The design solicitation required that the pump-turbine, when operating at a speed of 180 revolutions/min, should have an average pump and turbine efficiency of not less than 88.5%, where the pump efficiency is operating at a total head of 468 ft, and the turbine efficiency is measured at a net head of 448 ft. The average pump and turbine efficiency was found to be 92.6% which exceeds the requirement by 4.1%. (Geiger-PTT)
W87-08414

TECHNICAL PROGRESS IN HYDRAULICKING,
For primary bibliographic entry see Field 8H.
W87-08570

DEVELOPMENT OF THE TECHNOLOGY AND PROSPECTS OF USING HYDRAULICKING IN POWER CONSTRUCTION,
S. T. Rozinoer.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 528-532, September 1986. 1 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 10-13, September 1986.

Descriptors: *Hydraulic machinery, *Powerplants, *Hydraulic equipment, *Hydraulic structures, *Embankments, *Soil mechanics, *USSR, *Hydraulicking, Dams, Hydraulic fill, Construction, Dam construction, Construction methods.

The use of hydraulicking in powerplant construction in the USSR, especially in the postwar period, showed that this technology of earthworks has flexibility, adaptability to various construction and natural conditions, and the ability to lead to effective technical decisions during design and construction. Hydraulicking was used in the construction of thermal and nuclear power stations for building dams and embankments of off-channel and cutoff cooling basins by the hydraulic-fill method. Recent design and construction achievements in the USSR were detailed and current directions of hydraulicking technology were listed. (Wood-PTT)
W87-08571

DEVELOPMENT AND INTRODUCTION OF SEALING RINGS IN MUD PUMPS,
N. N. Kozhevnikov, and L. N. Neitman.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 533-536, September 1986. 2 fig, 4 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 13-16, September 1986.

Descriptors: *Hydraulic machinery, *Hydraulic equipment, *Pumps, *Mud pumps, *Sealing rings, USSR, Design criteria, Design standards, Hydraulic design.

Sealing the shaft or hub on the impeller in the majority of Soviet and foreign mud pumps is accomplished by means of a packing gland. To protect the gland from the entry of small particles, expulsive water under pressure is fed into the cavity in front of the seal. The small amount of abrasive material contained in the expulsive water enters the cavity in front of the seal and is retained by the gland. Manufacturing inaccuracies and installation errors also contribute to the intense wear and rapid failure of the gland. Flat rubber collar sealing rings were designed; design criteria, manufacture, and reliability were detailed. Seals were shown to be easy to manufacture, reliable, simple in operation, and effective and are, therefore, being placed in the delivery side of mud pumps used in the USSR. (Wood-PTT)
W87-08572

8D. Soil Mechanics

ANALYSES OF THE RELATIONSHIPS AMONG EXCHANGE CAPACITY (T-VALUE), PARTICLE SIZE, ORGANIC MATERIAL CONTENT OF SOILS AND SOIL REACTIONS FOR VARIOUS SUBSTRATA AND SOIL LEVELS (ANALYSE DES ZUSAMMENHANGES VON AUSTAUSCHKAPAZITAT (T-WERT) KORNUNG, ORGANISCHER BODENSUBSTANZ UND BODENREAKTION FUR VERBREITETE SUBSTRAT UND HORIZONTGRUPPEN),
Forschungszentrum fuer Bodenfruchtbarkeit Muencheberg (German D.R.).
J. Thiere, W. Reiher, and H. Morgenstern.
Archiv fuer Acker- und Planzenbau und Bodenkunde AAPBCE, Vol. 30, No. 4, p 211-218, 1986. 5 tab, 7 ref.

Descriptors: *Soil mechanics, *Mathematical equations, *Exchange capacity, *Particle size, *Organic matter, Soil chemistry, Analyses, Sediments, Clays, Regression analysis.

Hydrated and anhydrous samples of boulder marl from new pleistocene period and boulder clays from the old pleistonce period were analysed. Sediments and mountain clays were also included in the analyses (n = 1533 layers). Forty two test sets were made up by the combination of soil samples from different substrata and layers families. The interrelationship between the exchange capacity of the soil with the particle size, organic material content of the soil and the reaction with the soil were accomplished by developing five descriptive equations. From these results the various parameters of the regression equations were derived. From these regression equations the T-value for the finer soils (clays and fine dusts) were determined. This useful strategy with substrata and bed layers is necessary for deriving the values of the parameters. (Author's abstract)
W87-07798

SCIENTIFIC AND TECHNICAL PROGRESS IN THE DESIGN AND CONSTRUCTION OF EARTH DAMS,
M. Pavchich, and V. G. Padchenko.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 461-467, August 1986. 5 fig, 11 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 19-23, August 1986.

Descriptors: *Earth dams, *Dam construction, *Dam design, Sites, Hydroelectric power, Technology.

Earth dams have many advantages: (1) the possibility of using various sites and foundations; (2) use of cheap earth materials from borrow pits located in the immediate vicinity of hydro developments; (3) decrease in labor expenditures in connection with the use of highly productive machines and mechanisms and high level of mechanization and organization of the construction process; (4) reliable calculated substantiation of the design of dams; and (5) start-up of the hydroelectric stations at intermediate heads. In many cases the use of a number of progressive technologies promotes an improvement of the technical and economic indices of earth dams. Thus when earth dams are located on compressible and permeable foundations of various thickness, reliable watertight elements can be provided in them: (1) grout and concrete cutoffs; (2) earth or concrete walls made by the diaphragm wall method; and (3) grout curtains and blankets. Practically all types of soils, including weathered, waterlogged, weak, etc., can presently be used for constructing dams. Depending on the particular conditions of constructing dams and the presence of earth materials, various types of dam designs can be used. The cost effectiveness of earth dams is provided by using advanced construction technology and highly productive equipment. (McFarlane-PTT)
W87-07836

USE OF INTENSIVE IMPACT COMPACTION OF SOILS IN THE CONSTRUCTION OF DAMS AND EMBANKMENTS,
V. I. Vutsel', M. Y. Garitselov, and Y. K. Zaretskii.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 473-478, August 1986. 4 fig, 7 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 27-31, August 1986.

Descriptors: *Construction methods, *Construction equipment, *Dams, Damsites, Compaction, Embankments, Soil compaction.

Intensive impact compaction of embankments at the construction site of a pumped-storage station is being carried out in layers of 5-8 m each. Mass checking of the density and moisture content before and after compaction confirmed conclusions about the possibility of expression of moisture from saturated local volumes into the less moist surrounding soil. Thus a decrease of the requirements imposed on the initial quality of cohesive soils of the embankment is substantiated, which permits using soils and mixtures of soils differing in moisture content. Normally it is impossible to compact the saturated part to the specified controlled dry density by the traditional method of layer-by-layer rolling. In combination with the traditional technology of layer-wise rolling, intensive impact compaction substantially simplifies the procedure of checking the quality of compaction of each thin rolled layer by thoroughly checking once every 6-8 m of height of the structure. The maximum height of the layer of soil placed for compaction depends on a control index; the lower the index, the higher the requirements imposed on soil density. The depth of compaction does not increase with increase in the number of stages beyond two. The depth of compaction to the control dry density of the prescribed probability increases with increase of the initial average density of the embankment. The maximun height of the layer of fill depends on the density of placing the soil, which can be regulated by changing the method of constructing the embankment. (McFarlane-PTT)
W87-07838

IMPROVEMENT OF METHODS OF DETERMINING EARTH PRESSURE ON RETAINING WALLS,
Y. K. Zaretskii, E. I. Vorontsov, and S. A. Turdibekov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 484-491, August 1986. 4 fig, 2 tab, 8 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 34-38, August 1986.

Descriptors: *Soil engineering, *Soil mechanics, Soil compaction, Soil pressure, Earthworks, Embankments.

Lateral earth pressure was investigated under conditions of compression and plane strain under static and cyclic loads with three varieties of noncohesive soils: fine homogeneous sand for 3 initial density states, uniform sand of medium size, and gravel with particle size 5-10 mm. The values of the lateral earth pressure coefficient depend on the compressing pressure, decreasing with its increase. The values of the lateral earth pressure coeficient of noncohesive soils became practically independent of the applied stress when the applied stress is greater than a certain characteristic value equal to 0.15-0.2 MPa. The stablizing values of the lateral earth pressure coefficient depend little on the soil density but depend substantially on its composition. (McFarlane-PTT)
W87-07840

DEVELOPMENT OF THE TECHNOLOGY AND PROSPECTS OF USING HYDRAULICKING IN POWER CONSTRUCTION,
For primary bibliographic entry see Field 8C.
W87-08571

MORPHOLOGICAL CLASSIFICATION OF CANALS IN NATURAL SOILS,
V. I. Antropovskii.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 559-563, September 1986. 2 tab, 10 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 51-53, September 1986.

Descriptors: *Channel morphology, *Canals, *Soil mechanics, *Classification, *Fluvial sediments, Canal linings, Flow discharge, Soil types, Sediments, Deformation, Stable channels, Stability analysis.

A classification of earth, unlined canals, according to the character of the fluvial process, taking into account the discharge volume of the canals, their operating regime, and character of the underlying soil is given. The discharge volume and hydrological regime of canals are related to their purpose. The classification of unlined canals in the zone of through-flow of the sediments is expanded by taking into account the classes of canals with unidirectional deformations. Tables were prepared showing the main parameters, stability indices and character of stretches of unlined canals of different classes for use in designing earth canals. The proposed classification system is useful when developing schemes of regulating and preventing undesirable consequences of the fluvial process and when drawing up recommendations on methods and necessary degree of protection of canals. (Wood-PTT)
W87-08577

8E. Rock Mechanics and Geology

OVERVIEW OF THE CRETACEOUS IN ALBERTA,
Alberta Dept. of Environment, Edmonton.
For primary bibliographic entry see Field 2F.
W87-07756

GEOLOGY AND HYDROLOGY OF THE INYAN KARA FORMATION (LOWER CRETACEOUS), NORTH DAKOTA,
Shell Oil Co., Houston, TX.
B. L. Wartman.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 22-26, 10 fig, 7 ref.

Descriptors: *Dakota Aquifer, *Groundwater movement, *Geology, *Geohydrology, *Inyan Kara formation, *North Dakota, *Aquifer systems, *Aquifers, Sihstone, Sandstones, Shale, Coal, Aquifers, Transmissivity, Permeability coefficient, Salinity.

The Inyan Kara formation, the basal Cretaceous unit in North Dakota, forms the lower portion of the Dakota aquifer system in the state. The formation varies from +300 to -3,600 feet (+91.4 to -1,097.3 m) in elevation and 0 to 500 feet (0 to 152.4 m) in thickness. Study in the northwestern portion of the state suggests that the Inyan Kara is composed of three members. The lower member, 'A', is a nonmarine (fluvio-deltaic) unit of siltstone, sandstone, shale and coal. The middle member, 'B', is a marginal-marine (transgressive, tidal-flat and barrier-bar) unit of sandstone, siltstone and shale. The upper member 'C', is a shallow marine unit of interbedded siltstone and shale. The extent of these members is not known. The Inyan Kara is the shallowest regional aquifer in North Dakota. Permeability varies from 20 to 130 ft/day (6 to 40 m/d), transmissivity from 200 to 77,000 sq ft/d (18.6 to 7,153.3 sq m/d), TDS content from 2,000 to 19,000 mg/L, and head from 800 to 2,200 ft (244 to 670 m). The Inyan Kara is presently used for drinking water, disposal of hypersaline water from oil and gas wells and as a low-temperature geothermal resource. No economic discoveries of hydrocarbons have yet been made. (See also W87-07755) (Author's abstract)
W87-07758

HYDRODYNAMICS OF THE WILLISTON BASIN IN THE NORTHERN GREAT PLAINS,
Geological Survey, Lakewood, CO. Water Resources Div.
J. S. Downey.
IN: Geohydrology of the Dakota Aquifer, Proceedings of the First C.V. Theis Conference on Geohydrology, October 5-6, 1982, Lincoln Nebraska. National Well Association, 500 W. Wilson Bridge Road, Worthington, OH., 1984. p 92-98, 6 fig, 18 ref.

Descriptors: *Petroleum reservoirs, *Oilfields, *Dakota Aquifer, *Hydrodynamics, *Williston Basin, *Confined aquifers, *North Dakota, *Manitoba, *Saskatchewan, *South Dakota, Groundwater recharge, Aquifers, Vertical flow, Groundwater movement, Dissolved solids.

Paleozoic and Mesozoic rocks form at least five major confined aquifers in the Northern Great Plains of the United States. These aquifers underlie an area of more than 300,000 sq mi (777,000 sq km), from recharge areas in the northern Rocky Mountains and the Black Hills of South Dakota to discharge areas in eastern North Dakota, eastern South Dakota and the Canadian provinces of Manitoba and Saskatchewan. Vertically, the aquifers extend from surface exposures in the highland recharge areas to depths greater than 16,000 ft (4,900 m) in the Williston basin in North Dakota. Geologic structure is an important control on the rate and direction of water movement in the bedrock aquifers and confining layers. The major fault and lineament systems in the region channel groundwater flow into paths north and south around the Williston basin to discharge areas in eastern South Dakota, the Lake Agassiz basin of North Dakota and along Lakes Manitoba and Winnipeg in the Canadian province of Manitoba. Stratigraphic unconformities between Paleozoic and Mesozoic rocks along the northern edge of Williston basin in the Canadian provinces of Saskatchewan and Manitoba result in favorable conditions (traps) for the accumulation of oil and gas. These conditions limit groundwater flow northward from the basin. Unconformities also exist along the eastern edge of the Williston basin, but oil and gas accumulations are absent in this area. Available groundwater flow data indicate that flow takes place through and across the unconformities and may thereby have flushed any petroleum accumulations from existing traps. The Paleozoic aquifers in the Williston basin contain water with a dissolved-solid concentration in excess of 300,000 mg/L. In a static flow system, this dense water would be expected to accumulate in the deepest part of the basin. However, available data and simulation modeling of the hydrologic system indicate that the brine is not entirely static but is moving slowly toward discharge areas in the Lake Agassiz basin of eastern North Dakota and the province of Manitoba. The data also indicate that the brine is not in equilibrium with the existing flow systems but is adjusting to a hydrologic flow system developed after the retreat of the Wisconsin ice sheet, which covered the discharge area of the bedrock aquifers. (See also W87-07755) (Lantz-PTT)
W87-07768

DETERMINATION OF THE SCATTER DISTANCE OF ROCK PIECES DURING BLASTING UNDER POWER CONSTRUCTION CONDITIONS,
For primary bibliographic entry see Field 8H.
W87-07842

8F. Concrete

ROLLER COMPACTED CONCRETE DAMS WORLDWIDE,
Portland Cement Association, Denver, CO.
For primary bibliographic entry see Field 8A.
W87-07623

VIBRATION TECHNIQUES IN THE CONSTRUCTION OF LARGE DAMS,
For primary bibliographic entry see Field 8A.
W87-07837

CONCERNING THE STANDARD REQUIREMENTS IMPOSED ON THE STRENGTH OF CONCRETE FOR DAMS,
V. N. Durcheva, A. N. Marchuk, G. T. Mikeladze, V. B. Sudakov, and M. A. Marchuk.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 497-508, August 1986. 10 fig, 3 tab, 22 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 43-50, August 1986.

Descriptors: *Safety, *Concrete dams, *Concrete construction, *Concrete technology, Powerplants, Hydroelectric plants.

This study examines the substantiation of the standard requirements imposed on concrete strength of dams. Having analyzed the data on the concrete strength and temperature regimes of concrete dams constructed in the USSR in recent decades, the authors suggest using for dams a concrete safety factor equal to 1 and to take more than the presently established 180 days as the basic grade age. With the modern technological systems being used in dam construction there are no grounds for using the so-called concrete safety factor. The standard strength of concrete, rather than the calculated, should be used when calculating the static work of dams and assigning the strength requirements of concretes. The reduction in the content of cement in concrete by 40-70 kg/cu m of concrete as a result of such a change in the standard requirements would substantially increase the effectiveness of measures on ensuring solidity of the concrete masonry of dams, since one of the principal causes of thermal cracking is the high content of cement. The grade strength of concrete of dams should be timed to an age of one year. In individual cases for the largest structures whose construction time takes more than 3 years, the period can be extended. The grade age of concrete of various parts of dams should be assigned on the basis of the calendar schedule of placing concrete in the structure with consideration of the duration of filling the reservoir to the normal pool level. For the volume of concrete being placed in the last year of construction, the grade age of concrete with respect to strength should be 6 months. For dams located in regions with negative mean annual temperatures the grade strength should be assigned on the basis of the calendar schedule of concrete and duration of filling the reservoir. For buttress dams in these regions the grade age of concrete should be 6 months, and increased to one year only for concrete placed during the spring and summer. (McFarlane-PTT)
W87-07843

METHODS FOR CONTROLLING EFFECTS OF ALKALI-SILICA REACTION IN CONCRETE,
Army Engineer Waterways Experiment Station,

Vicksburg, MS. Structures Lab.
A. D. Buck, and K. Mather.
Available from the National Technical Information Service, Springfield, Virginia 22161, as ADA-178479. Price codes A04 in paper copy and A01 in microfiche. Technical Report SL-87-6, February 1987. Final Report. 61 p, 44 tab, 9 ref.

Descriptors: *Concretes, *Concrete technology, *Alkalinity, *Chemical reactions, *Silica, Aggregates, Pozzolans, Fly ash, Igneous rocks, Materials testing.

This research project concerned methods of minimizing the effects of alkali-silica reaction in concrete. Ten pozzolans were tested to determine how they could most effectively be used to maximize reduction of expansion due to alkali-silica reqction when the pessium amounts of opal or of reactive glassy igneous rock were used as aggregate with cements of several levels of alkali content. Three of these pozzolans (fly ash AD-505, fly ash AD-509, and natural pozzolan AD-518) were selected for further work and were used at selected levels of cement replacement with pessium amounts of opal, glassy igneous rock, and an estimated pessium for chert with each of two high-alkali cements. In general, use of these pozzolans at their optimum levels was an effective procedure as expansions of several tenths of a percent were usually reduced to a few hundredths. It was also found that some fly ashes when used at about 30% cement replacement level actually caused more expansion, especially with low-alkali cement. This is believed to be due to the additional water-soluble alkali provided by the fly ash to the system. Work was done with different mineral fractions of a reactive granite gneiss plus the whole rock to identify the reactive constituent; it was concluded that the reactivity of the granite gneiss was due to strained quartz as a constituent mineral. Work with combinations of silica fume and calcium hydroxide with water showed the reactivity of the fume and identified a well crystallized calcium silicate as the reaction product. (Author's abstract)
W87-08220

8G. Materials

USE OF NEW ANTIFRICTION MATERIALS IN HEAVILY LOADED THRUST BEARINGS OF TURBINE-GENERATOR UNITS,
For primary bibliographic entry see Field 8C.
W87-07841

8H. Rapid Excavation

DETERMINATION OF THE SCATTER DISTANCE OF ROCK PIECES DURING BLASTING UNDER POWER CONSTRUCTION CONDITIONS,
E. I. Shifrin.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 494-496, August 1986. 1 fig, 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 41-42, August 1986.

Descriptors: *Scatter distance, *Rapid excavation, *Blasting, *Explosives, *Hazardous materials, *Safety, Construction methods, Powerplants, Hydroelectric plants, Prediction.

Blasting of rock by hole charges creates flying pieces of rock which may damage nearby buildings and structures and threaten people. It is important to be able to accurately predict the scatter distance of the rock pieces. Safety regulations currently recommend calculating the scatter distance of rock pieces for hole charges by reducing them to concentrated crater charges. This method of calculation is inaccurate due to the noncorrespondence of physical phenomena during blasting of concentrated and elongated charges. A comparison of several alternative formulas was carried out by inspecting a multitude of variants in the relations between scatter distance and those factors shown to effect scatter distance, such as strength coefficient, height of ledge, hole pattern, stemming length, linear mass of charge, powder factor, and charge length. By converting from a row-by-row delay scheme to a diagonal delay scheme, as well as hole-by-hole blasting, it is possible to reduce the scattering distance. (McFarlane-PTT)
W87-07842

USE OF TRENCH AND PIT CRATER CHARGES AT THE CONSTRUCTION SITE OF THE HOA-BINH HYDRO DEVELOPMENT,
V. A. Kuznetsov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 517-521, August 1986. 2 fig, 1 tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 57-60, August 1986.

Descriptors: *Rapid excavation, *Blasting, *Explosives, *Cofferdams, Da River, Hoa-Binh, Vietnam, Construction methods.

At the construction site of the Hoa-Binh hydro development in Vietnam a series of crater explosions was carried out to open and eliminate the cofferdams of the temporary diversion canal. Crater blasting was necessary owing to the lack of powerful excavators with backhoe equipment and lack of time set for the start of damming the Da River. For using the available experimental and calculation-methodological principles of crater blasting in the less studied practice of blasting cofferdams and embankments, it is expedient to keep as one of the main calculation parameters the index of action of the blast, having transformed it to the ratio of the depth of the blasted cut and depth of the charge. (McFarlane-PTT)
W87-07846

TECHNICAL PROGRESS IN HYDRAULICKING,
N. N. Kozhevnikov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 9, p 523-527, September 1986. 4 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 6-10, September 1986.

Descriptors: *Hydraulic machinery, *Hydraulic equipment, *Dredging, *Hydraulic design, *Excavation, *USSR, Hydraulicking, Design criteria, Sand, Alluvial soils, History.

The use of hydraulicking is effective when excavating non-cohesive alluvial soils, such as sand, loamy sand, or sand-gravel. Pits containing these types of soils are often located in river floodplains and are therefore frequently flooded and inaccessible for dry excavation equipment. The history of use of dredges and of the improvements made in hydraulic machinery and dredge design was detailed. Modernization of individual components of hydraulicking equipment at the State All-Union Trust for Planning and Performing Hydraulicking Works over the last 40 years has increased productivity by 2-3% per year. The improvement in the design of hydraulicking equipment is ongoing. (Wood-PTT)
W87-08570

DEVELOPMENT OF THE TECHNOLOGY AND PROSPECTS OF USING HYDRAULICKING IN POWER CONSTRUCTION,
For primary bibliographic entry see Field 8C.
W87-08571

8I. Fisheries Engineering

CONTAMINANT EFFECTS ON FISHERIES.
Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch.
For primary bibliographic entry see Field 5C.
W87-07631

APPRAISING THE STATUS OF FISHERIES: REHABILITATION TECHNIQUES,
Ontario Ministry of Natural Resources, Thunder Bay. Fisheries Research Section.
For primary bibliographic entry see Field 5C.
W87-07647

PROBLEM OF PROTECTING FISH AT WATER INTAKES,
V. S. Mishchenko, and V. N. Pestryakov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 8, p 509-512, August 1986. 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 50-52, August 1986.

Descriptors: *Fish barriers, *Fish passages, *Fish management, Lake fisheries, Reservoir fisheries, Entrainment.

Hydraulically substantiated protective screens bathed by water jets can reduce fish entrainment at water intakes. Hydraulic fish protective devices (FPDs) have been tested under experimental and actual conditions with a 90 to 100% effectiveness protecting young fish when the design parameters are fulfilled. The presence of a screen bathed by water jets does not preclude the need for periodic cleaning of the screen (occluded by plant trash), the possibility of interruptions in the passage of the necessary water discharges, and hydraulic conditions under which injury and death of young fish is possible, especially with the use of shutters. Other techniques would include using the bend of a curvilinear canal with a fish diversion at the head of a concave bank as a FPD. The use of an air-bubble curtain for protecting young fish from entering intakes deserves attention. Rather than pure compressed air, the addition of a concentrate of a substance having an acrid odor which might frighten fish away from the air-bubble curtain is suggested. The removal of young fish by air-lift currents into the surface water layers is also suggested. When combined with a floating boom deflector to deflect fish to a diversion, the young fish would be lifted to the surface immediately in front of the boom and diverted to safety. (McFarlane-PTT)
W87-07844

LOSS OF LAMPRICIDES BY ADSORPTION ON BOTTOM SEDIMENTS,
National Fishery Research Lab., La Crosse, WI.
V. K. Dawson, D. A. Johnson, and J. L. Allen.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 8, p 1515-1520, August 1986. 2 fig, 7 tab, 13 ref.

Descriptors: *Lampricides, *Piscicides, *Adsorption, *Bottom sediments, *Pesticides, *River sediments, *Water quality management, Path of pollutants, Sediments, Great Lakes, Lamprey, Fish, Chemical properties, Acidity.

Problems have been encountered in maintaining effective concentrations of the lampricides 3-trifluoromethyl-4-nitrophenol (TFM) and 5,2'-dichloro-4' nitrosalicylanilide (Bayer 73) during treatments of certain Great Lakes tributaries. Concentrations of Bayer 73 decreased by more than 80% in a portion of the Ford River, Michigan during treatment in 1980. Therefore, experiments were conducted to determine if adsorption by certain sediments was contributing to this loss. Laboratory studies demonstrated that lampricides are adsorbed by silt-type sediments that are high in organic content, including those collected from the treated portion of the Ford River. Un-ionized lampricides (acidic solution) were more readily adsorbed than ionized forms (basic solution). Adsorption onto sediments was proportionally greater, and desorption proportionally less, for Bayer 73 than for TFM. When Ford River sediments were mixed with lampricide-free water, less than 10% of the adsorbed Bayer 73, but more than 60% of the TFM, was released. It is concluded that the extensive adsorption of the lampricides (especially Bayer 73) from solution by silt-type sediments explains much of the loss of effective concentrations in certain streams. (Author's abstract)
W87-07882

RELATIONSHIPS BETWEEN STREAM AND INTRAGRAVEL TEMPERATURES IN COASTAL DRAINAGES, AND SOME IMPLICATIONS FOR FISHERIES WORKERS,
Department of Fisheries and Oceans, Vancouver (British Columbia).
For primary bibliographic entry see Field 2H.

W87-07896

EFFECTS OF FLUCTUATING TEMPERATURE ON MORTALITY, STRESS, AND ENERGY RESERVES OF JUVENILE COHO SALMON,
National Marine Fisheries Service, Kodiak, AK. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 2H.
W87-08041

MERCURY CONTENT OF SHRIMP (PENAEUS VANNAMED) REARED IN A WASTEWATER-SEAWATER AQUACULTURAL SYSTEM,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W87-08115

EVALUATION OF GROWTH AND PRODUCTION OF JARAQUIS (SEMAPROCHILODUS SPP) IN A TERRA FIRMA STREAM IMPOUNDMENT IN THE ENVIRONS OF MANAUS, AMAZONAS (AVALIACAO DO CRESCIMENTO E DA PRODUCAO DE JARAQUIS (SEMAPROCHILODUS SPP), EM DE IGARAPE DE TERRA FIRME NOS ARREDORES DE MANAUS, AMAZONAS),
Instituto Nacional de Pesquisas da Amazonia, Manaus (Brazil).
For primary bibliographic entry see Field 2H.
W87-08274

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

SURVEY OF CONTAMINANT HYDROGEOLOGY IN CANADA,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W87-07803

9B. Education (In-House)

RIGHT-TO-KNOW AT A WASTEWATER TREATMENT PLANT: THE ALCOSAN EXPERIENCE,
M. D. McFalls.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 20, No. 2, p 9-10, 22, March-April 1987.

Descriptors: *Education, *Training, *Employee education, *Community education, *Right-to-Know Act, *Wastewater facilities, *Water treatment facilities, Wastewater treatment, Hazards, Information exchange, Hazardous materials, Poisons, Toxins, Planning, Chlorine.

The Allegheny County Sanitary Authority, ALCOSAN, has completed the bulk of its Right-to Know Compliance Program which adheres to the Pennsylvania Worker and Community Right-to-Know Act which is designed to provide employees and the general public with health information about the toxic substances found in the workplace. The implementation of a Right-to-Know Compliance program for the large wastewater treatment facility for the City of Pittsburgh and 78 neighboring municipalities required extensive planning and use of consultants. An overview of the law and details of the steps taken by ALCOSAN are presented. All chemicals used at the plant were identified, Material Safety Data Sheets were obtained for each chemical used, and chemical containers were checked for appropriate identification and hazard labels. All employees attended general training sessions and special training sessions were held for those employees handling particularly hazardous materials. In addition, ALCOSAN chose to make the voluntary effort to sponsor a meeting open to the community to discuss the hazardous substances at the plant, specifically chlorine. The ALCOSAN experience helped the employees and the community and showed the ability of a wastewater treatment plant to come into full compliance with the Right-to-Know Law. (Wood-PTT)
W87-07868

PROVIDING SECTION SERVICES IN TECHNICAL INFORMATION AND TRAINING,
American Water Works Association, Denver, CO.
D. B. Preston.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 37-45.

Descriptors: *Technical societies, *Information exchange, *Training, American Water Works Association, Education, Economic aspects, Organizations.

The American Water Works Association's (AWWA's) training and technical information programs have been undergoing a major evolutionary change over the past several years. The planning, development, and implementation of various programs administered by the education department have been a time-consuming process; currently, however, established programs are online and new directions are being examined to expand and improve member service. Perhaps one of the most recent and significant changes in program direction has resulted from a reorganization of the education department and the assignment of staff to a materials development section. This group of people is responsible for the preparation and recent publication of a Chlorination Training Package. The training package concept is a new thrust for the Association in providing training alternatives that have not existed before. The chlorination package has been prepared in 10 individual modules of instruction and offers the user several options for conducting inservice training sessions on a short- or long-term basis. The use of packaged program materials is not only an efficient method of providing training and improving operating performance, but probably the most cost-effective. It is more economical than paying registration fees, transportation costs, and per diem expenses for outside training. Here are some advantages that should be evaluated in considering the purchase of a packaged training course: (1) training expenses can be shared with neighboring utilities; (2) training can be adapted to deal with inplant operating problems; (3) instruction can be paced to the learning rate and interests of plant operation staff; (4) course materials can be taught at a time most convenient to the work schedule; and (5) instructional materials are reusable. They will be around for a long time, providing opportunities to hold refresher courses or train new employees. As fewer and fewer dollars are appropriated for training at the national level, it will become increasingly important that AWWA sections as well as local utilities provide the necessary training for their employees. (See also W87-08420) (Lantz-PTT)
W87-08423

9C. Research Facilities

ANNUAL REPORT: 1983. ENVIRONMENTAL MEASUREMENTS LABORATORY, USDOE.
Department of Energy, New York. Environmental Measurements Lab.
Available from the National Technical Information Service, Springfield, Virginia 22161, as DE84-013758. Price codes: A06 in paper copy, A01 in microfiche. Report No. EML-423, March 1984. 115 p, 27 fig, 1 tab, 27 ref.

Descriptors: *Environmental assessment, *Lakes, *Reservoirs, *Acid water, *Research facilities, Environmental protection.

The 1983 Annual Report of the DOE Environmental Measurements Laboratory, is presented as a series of short descriptions of each of the more than 100 projects in which the EML was actively engaged during the year. They are grouped by broad programmatic headings under the organizational units of the Laboratory. Following the technical abstracts are sections describing the organization, staff, outside activities and in house publications and presentations. While the abstracts appear in the section of the lead author's Division or Branch, many projects are multi-organizational and are so noted in this report by joint authorship and cross referencing. 1983 saw another reduction in the Laboratory's personnel ceiling from 95 full-time equivalent (FTE) to 93. In just seven years staff reduction has been twenty-six FTE, in excess of 21%. In December, a two and one half day review of the technical programs was conducted at the Laboratory for the Office of Health and Environmental Research (OHER). In all, there were seven non-DOE reviewers and six from OHER. Twenty short papers summarizing the presentations will be published as an EML report (publication in progress). The staff was again involved in rather extensive field work in 1983, for the most part continuing the study of acidified lakes, the use of lake and reservoir sediments for understanding regional pollution history and further research on evaluating U.S. population doses from fallout resulting from atmospheric nuclear tests in Nevada, in the 1950's. (Lantz-PTT)
W87-08241

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

ASSESSMENT OF TOXIC SUBSTANCE INFORMATION SOURCES,
Technical Resources, Inc., Bethesda, MD.
A. Lee.
IN: Hazard Assessment of Chemicals: Current Developments, Vol. 1, Academic Press, New York. 1981. p 1-16, 1 tab.

Descriptors: *Data acquisition, *Computers, *Hazardous materials, Data collections, Data processing, Data storage and retrieval, Data transmission, Networks, Toxins.

This article reviews the various data sources available to those government agencies charged with the responsibility of assessing the health and/or environmental hazards of chemical substances. Two of the largest commercial computerized database dealers, Systems Development Corporation and Lockheed Information System, offer access to data bases in chemistry, biology, environmental sciences, business, energy, and sociology. Access to handbooks and data compendia will also facilitate the assessment of a chemical's potential hazard. Problems in data gathering have often been encountered when searching for information on a chemical's method of manufacture and production, and use or exposure. The EPA maintains data on wastewater treatment processes in the Section 308 data base. The EPA is developing a Chemical Substance Information Network (CSIN) to collect and develop data to assess potential health and environmental effects of chemical substances. Preliminary designs for CSIN show seven subsystems with the ability to add subsystems as the need arises. (See also W87-08394) (Geiger-PTT)
W87-08395

MANAGEMENT INFORMATION SYSTEMS FOR WATER RESOURCES,
North Carolina State Univ. at Raleigh.
F. J. Smith.
IN: Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water, April 14-15, 1981, Denver, Colorado. National Bureau of Standards Special Publication No. 624, June 1982. p 347-352, 3 tab.

Descriptors: *Information systems, *Water resources development, *Information exchange, Water management, Cost analysis, Water systems, Utilities, Rates, Training, Water conservation, Public relations.

Water utility managers are confronted repeatedly with difficult decisions which require a good information support base. Attempts to increase efficiency in water resource utilization through conservation will generate even further demands for information to track program efforts in consumer education, leak detection, regulation and enforcement, pricing, emergency allocation, and comprehensive planning to name only a few. Unless preparation is made to meet these informational prerequisites of management on a broad scale, efforts to boost efficiency through conservation will surely fizzle. Several large metropolitan and suburban water systems have led the way in development of sophisticated information systems, computer models, and information specialists. Reports of their experiences suggest that the payback to systems in reduced cost of development and operations is attractive. Yet most large systems have not followed this lead and conservation remains the stepchild of water management activities. Furthermore, for smaller water systems these models are simply not applicable given their special information needs and their severe constraints of system resources. With this in mind, water agency personnel were surveyed to identify efficient sets fo information for water systems (large, medium, and small) on which water management can confidently develop and operate programs including water conservation--at minimum cost. Two major objectives guide the research program which are particularly relevant to this conference: (1) identify management problems from the different perspectives of local water utility, industry, and citizens--as a first step toward targeting management information to State and local problems; and (2) identify an efficient set of information elements--to support water utility management and their affiliated consultants in planning, operations, rate setting, allocation, public participation, staff training, and conservation programs. (See also W87-08420) (Lantz-PTT)
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Annual Effluent and Environmental Monitoring Report for Calendar Year 1981.
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Physiological Responses of Fish: Problems and Progress Toward Use in Environmental Monitoring,
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Species Diversity and Structure of Meiobenthic Communities in a Lagoon Ecosystems (Diversite Specifique et Structure des Peuplements Meiobenthiques d'un Ecosysteme Lagunaire),
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Effect of Fertilizer on the Growth of Radish Plants Exposed to Simulated Acidic Rain Containing Different Sulfate to Nitrate Ratios,
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Trend Determination of Pollution Load at Different Discharges by the Example of Heavy Metal Concentrations in Suspended Sediments (Trendermittlung bei Unterschiedlichen Abfluessen am Beispiel der Schwermetallgehalte von Schwebstoffen),
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Rainfall Characteristics of the Prescott, Arizona, Storm of 23-24 September 1983,
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CALIFORNIA UNIV., DAVIS. DEPT. OF AGRICULTURAL ECONOMICS.
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Irrigation With Reclaimed Municipal Wastewater-A Guidance Manual.
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Effects of Fish and pH on the Distribution and Abundance of Backswimmers (Hemiptera: Notonectidae),
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CENTRE DE RECHERCHES PETROGRAPHIQUES ET GEOCHIMIQUES, NANCY (FRANCE).
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Columbia River Estuary Data Development Program (CREDDP). Dynamics of the Columbia River Estuarine Ecosystem. Volume 1,
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COMMISSION OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY). JOINT RESEARCH CENTRE.
Studies on the Absorption of TCDD by Plant Species,
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Glyphosate-Sediment Interactions and Phytotoxicity in Turbid Water,
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COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF PLANT INDUSTRY.
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
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COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF WATER AND LAND RESOURCES.
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Computerized Management of Fluvial Plants with Multiple Aims: The Rhone Example (La Gestion Automatisee d'Amenagements Fluviaux a Buts Multiples: L'Exemple du Rhone),
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Rates of Dissolution and Biodegradation of Water-Insoluble Organic Compounds,
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DEPARTMENT OF AGRICULTURE, LENNOXVILLE (QUEBEC). STATION DE RECHERCHES.
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DEPARTMENT OF AGRICULTURE, LETHBRIDGE (ALBERTA). RESEARCH STATION.
Seasonal Occurrence of, Development of, and the Influences of Selected Environmental Factors on the Larvae of Prosimulium and Simulium Species of Blackflies (Diptera:Simuliidae) Found in the Rivers of Southwestern Alberta,
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Pitfalls in Interpretation of Soil Drainage from Soil Survey Information,
W87-07907 2G

DEPARTMENT OF ENERGY, NEW YORK. ENVIRONMENTAL MEASUREMENTS LAB.
Annual Report: 1983. Environmental Measurements Laboratory, USDOE.
W87-08241 9C

DEPARTMENT OF FISHERIES AND OCEANS, BURLINGTON (ONTARIO). GREAT LAKES FISHERIES RESEARCH BRANCH.
Contaminant Effects on Fisheries.
W87-07631 5C

DEPARTMENT OF FISHERIES AND OCEANS, HALIFAX (NOVA SCOTIA). FISHERIES RESEARCH BRANCH.
Effects of Pollutants and Contaminants on Steroidogenesis in Fish and Marine Mammals,
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DEPARTMENT OF FISHERIES AND OCEANS, ST. ANDREWS (NEW BRUNSWICK).
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Rangeland: Conservation Needs, Technology, and Policy Alternatives,
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Effect of the Depth of Atmospheric Pressure and Ground Water Free Lysimeter on the Drainage Water Discharge and Evaporation (Einfluss der Tiefe grundwasserfreier Lysimeter ohne Unterdruck duf Sickerwasserablauf; und Verdunstung),
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INDIAN INST. OF TECH., KHARAGPUR. DEPT. OF AGRICULTURAL ENGINEERING.
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Obligately Phototrophic Chloroflexus: Primary Production in Anaerobic Hot Spring Microbial Mats,
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INDUSTRIAL TOXICOLOGY RESEARCH CENTRE, LUCKNOW (INDIA).
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INSTITUT ARMAND-FRAPPIER, LAVAL (QUEBEC). CENTRE DE RECHERCHE EN VIROLOGIE.
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INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE, SAINTE-FOY (QUEBEC).
Prediction of Temperatures in Rivers Using a Conceptual Model (Prevision des Temperatures de l'eau en Riviere a l'aide d'un Modele Conceptuel),
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Partial Duration Series Modeling Under the Assumption of a Poissonian Flood Count,
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INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE LYON, VILLEURBANNE (FRANCE). LAB. DE CHIMIE ET GENIE DE L'ENVIRONNEMENT.
Recent Developments in the Treatment of Oily Effluents,
W87-08549 5D

INSTITUT PASTEUR HELLENIQUE, ATHENS (GREECE). DEPT. OF VIROLOGY.
Viral Pollution of Coastal Waters Resulting from the Disposal of Untreated Sewage Effluents,
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INSTITUT RUDJER BOSKOVIC, ZAGREB (YUGOSLAVIA). CENTER FOR MARINE RESEARCH.
Preliminary Results of the Joint Italian-Yugoslav Research Program on the Pollution of the Adriatic Sea,
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INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH, PLYMOUTH (ENGLAND).
Nutrient Cycling Studies in Carmarthen Bay: Phytoplankton Production, Nitrogen Assimilation and Regeneration,
W87-07942 2L

INSTITUTE FOR PHYSICAL PLANNING AND THE PROTECTION OF THE ENVIRONMENT, ISTARSKA (YUGOSLAVIA).
Wastewater Disposal in the Rijeka Region,
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INSTITUTE FUER DUENGUNGSFORSCHUNG LEIPZIG-POTSDAM, LEIPZIG (GERMAN D.R.).
Gas Chromatographic Measurement of Nitrogen Removal Activity Below the Marshy Soils in the Federal Republic of Germany Through a Drainage Tube (Messung der Denitrifikations-aktivitat von drainierten Niedermoorboden der DDR mit Hilfe der Gaschromatographie),
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INSTITUTE OF AMERICAN RESEARCH, TUCSON, AZ.
Petroglyphs of the Picacho Mountains, South Central, Arizona,
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INSTITUTE OF AQUATIC BIOLOGY, ACHIMOTA (GHANA).
Fish Head Acetylcholinesterase Activity After Aerial Application of Temephos in Two Rivers in Burkina Faso, West Africa,
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INSTITUTE OF ECOLOGY, INDIANAPOLIS, IN.
Use of Forest Site Index for Evaluating Terrestrial Resources at Risk from Acidic Deposition,
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INSTITUTE OF EUROPEAN ENVIRONMENTAL POLICY, BONN (GERMANY, F.R.).
International Aspects of Acid Rain: Where Do We Stand,
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INSTITUTE OF GEOLOGICAL SCIENCES, LONDON (ENGLAND). METALLIFEROUS MINERALS AND APPLIED GEOCHEMISTRY UNIT.
Principles of Environmental Geochemistry,
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INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
Derivation of a Catchment Average Unit Hydrograph,
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INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT, WARSAW (POLAND).
Dispersion of Pollutants in Rivers,
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INSTITUTE OF PUBLIC HEALTH, ZAGREB (YUGOSLAVIA).
Principles and Criteria for the Protection of Water Against Pollution from Hospitals in the Mediterranean Coastal Region,
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INSTITUTO NACIONAL DE PESQUISAS DA AMAZONIA, MANAUS (BRAZIL).
Evaluation of Growth and Production of Jaraquis (Semaprochilodus spp) in a Terra Firma Stream Impoundment in the Environs of Manaus, Amazonas (Avaliacao do Crescimento e da Producao de Jaraquis (Semaprochilodus spp), em de Igarape de Terra Firme nos Arredores de Manaus, Amazonas),
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INSTITUUT TNO VOOR WISKUNDE, INFORMATIEVERWERKING EN STATISTIEK, DELFT (NETHERLANDS). INST. OF APPLIED COMPUTER SCIENCE.
Estimation of the Generalized Covariance When It is a Linear Combination of Two Known Generalized Covariances,
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Flow Reduction: Methods, Analysis Procedures, Examples,
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WIPP Hydrology Program Waste Isolation Pilot Plant Southeastern New Mexico,
W87-08219 2F

WIPP Hydrology Program Waste Isolation Pilot Plant Southeastern New Mexico: Hydrologic Data Report 3.
W87-08245 2F

INTERAGENCY TASK FORCE ON ACID PRECIPITATION, WASHINGTON, DC.
Annual Report, 1984.
W87-07728 2B

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION, BOISE, ID. FORESTRY SCIENCES LAB.
Forest Land: Conservation Needs, Technology, and Policy Alternatives,
W87-07686 2J

INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES.
Techniques for Prediction of Runoff from Glacierized Areas.
W87-07708 2C

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).
Isotopic Composition of Precipitation in Tropical Stations,
W87-08275 2B

INTERNATIONAL INST. OF TROPICAL AGRICULTURE, IBADAN (NIGERIA).
Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-07922 3F

INTERNATIONAL JOINT COMMISSION-UNITED STATES AND CANADA, WINDSOR (ONTARIO).
International Joint Commission: 1983-1984 Activities Report.
W87-07725 6E

INTERNATIONAL JOINT COMMISSION-UNITED STATES AND CANADA, WINDSOR (ONTARIO). STANDING COMMITTEE ON THE SCIENTIFIC BASIS FOR WATER QUALITY CRITERIA.
Report of the Aquatic Ecosystem Objectives Committee: 1985 Annual Report.
W87-07724 5G

IOWA STATE UNIV., AMES. DEPT. OF AGRONOMY.
Modeling Saturated-Unsaturated Water Flow in Soils,
W87-08587 2G

IOWA STATE UNIV., AMES. DEPT. OF ANIMAL ECOLOGY.
Symbiosis between Salamander Eggs and Green Algae: Microelectrode Measurements inside Eggs Demonstrate Effect of Photosynthesis on Oxygen Concentration,
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IOWA UNIV., IOWA CITY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Radium Removal Using Sorption to Filter Sand,
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ISRAEL ELECTRIC CORP. LTD., HAIFA.
Periodic Optimal Control With Application to Pumped Storage Plants,
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Sampling Strategy for Remedial Action at Hazardous Waste Sites: Cleanup of Soil Contaminated by Tetrachlorodibenzo-p-dioxin,
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Risk Analysis: Solid Wastes from Oil Shale as an Example of the Use of Health Effects and Ecological Data for Risk Estimation,
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JACOBS ENGINEERING GROUP, INC., WASHINGTON, DC.
Ozone Treatment of Industrial Wastewater,
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JAMES N. GAMBLE INST. OF MEDICAL RESEARCH, CINCINNATI, OH.
Characterization of Virucidal Agents in Activated Sludge,
W87-08287 5D

JAPAN ATOMIC ENERGY RESEARCH INST., TAKASAKI. TAKASAKI RADIATION CHEMISTRY RESEARCH ESTABLISHMENT.
Disinfection of Sewage Sludge Cake by an Electron Accelerator,
W87-07966 5D

JAWAHARLAL NEHRU UNIV., NEW DELHI (INDIA). SCHOOL OF ENVIRONMENTAL SCIENCES.
Effect of Copper and Cadmium on Carbon Assimilation and Uptake of Metals by Algae,
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JEFFERSON ASSOCIATES, INC., SAN FRANCISCO, CA.
Effects of Water Conservation on Municipal Wastewater Treatment Facilities,
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JOHNS HOPKINS UNIV., BALTIMORE, MD. SCHOOL OF MEDICINE.
Derivatives of Dicyclopentadiene in Ground Water,
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KAINJI LAKE RESEARCH INST., NEW BUSSA (NIGERIA).
Studies on Some Aspects of the Biology of Pellonula Afzeliusi (Johnels) in Epe Lagoon, Nigeria,
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KANSAS UNIV., LAWRENCE. DEPT. OF GEOLOGY.
Geochemistry and Water Quality,
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KAPALOSKI, KINGHORN AND ALDER, SALT LAKE CITY, UT.
Water Conservation/Flow Reduction in Facilities Planning for Salt Lake County,
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KARLOVA UNIV., PRAGUE (CZECHESLOVAKIA).
Influence of IAA on the Uptake of Potassium, Calcium, Magnesium, Water Absorption and Growth in Young Maize Seedlings,
W87-07813 2I

KARNATAKA REGIONAL ENGINEERING COLL., SURATKAL (INDIA).
Velocity Distribution in Alluvial Channel Flow,
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KENT STATE UNIV., OH. DEPT. OF GEOLOGY.
Gravity Modeling of the Brimfield Township Buried Valley and Associated Aquifer, Portage County, Ohio,
W87-07851 2F

KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (GERMANY, F.R.). INST. FUER ANGEWANDTE PHYSIKALISCHE CHEMIE.
Ultratrace Analysis of Mercury and Methylmercury (MM) in Rain Water Using Cold Vapour Atomic Absorption Spectrometry,
W87-08599 5A

KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (GERMANY, F.R.). PROJEKTTRAEGER FUER UMWELTCHEMIKALIEN.
Methods to Evaluate Ecotoxicological Effects of Chemicals (Methoden zur Okotoxikologischen Bewertung von Chemikalien),
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KERNFORSCHUNGSZENTRUM KARLSRUHE G.M.B.H. (GERMANY, F.R.). INST. FUER RADIOCHEMIE.
Influence of the Initial Concentration of Organic Model Compounds on the Results of Ozonation (Einfluss der Ausgangskonzentration Organischer Stoffe im Wasser auf die Wirkung der Ozonung),
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KEURINGSINSTITUUT VOOR WATERLEIDINGARTIKELEN, RIJSWIJK (NETHERLANDS).
Water Quality in Distribution Networks,
W87-07784 5F

KIEL UNIV. (GERMANY, F.R.). INST. FUER MEERESKUNDE.
Influence of Temperature, Salinity, and Oxygen on the Cadmium Balance of Mussels Mytilus edulis,
W87-08029 2L

KING ABDULAZIZ UNIV., JEDDAH (SAUDI ARABIA). DEPT. OF CHEMICAL ENGINEERING.
Extraction and Preconcentration of Selenium from Aqueous Solutions and Its Determination in Water and Hair Samples by Atomic-Absorption Spectrophotometry,
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KING'S COLL., LONDON (ENGLAND). DEPT. OF BIOLOGY.
Thousand Years of Death,
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KING SAUD UNIV., RIYADH (SAUDI ARABIA). DEPT. OF CIVIL ENGINEERING.
Analysis of Rainfall in the South-West Region of Saudi Arabia,
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KONSTANZ UNIV. (GERMANY, F.R.). LIMNOLOGICAL INST.
Comparison of Mechanisms Enhancing Biodegradability of Refractory Lake Water Constituents,
W87-07947 2H

KYUSHU UNIV., FUKUOKA (JAPAN). DEPT. OF APPLIED CHEMISTRY.
Ozonation Rate of Water-Soluble Chelates and Related Compounds,
W87-08016 5D

LA SALLE LTD. (QUEBEC). LAB. D'HYDRAULIQUE.
Andekalela Water Intake Characteristics for Excluding Sediments (Caracteristiques de la Prise d'Eau a Andekalela pour l'Exclusion des Sediments),
W87-08279 8A

LABORATOIRE CENTRAL DES PONTS ET CHAUSSEES, BOUGUENAIS (FRANCE).
Determination of Tin in Sediments and Sewage Sludges by Atomic Absorption Spectrometry with Hydride Generation (Determination de L'etain Dans les Sediments et les Boues Destations D'Epuration par Spectrmetrie D'Absorption Atomique avec Generation D'Hydrures),
W87-08082 7B

LABORATOIRE D'HYDROLOGIE, PARIS (FRANCE). FACULTE DES SCIENCES PHARMACEUTIQUE ET BIOLOGIQUE.
Analysis of Residual Bromine in Water in the Presence of Ammonia Nitrogen by the DPD Method,
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LAGOS UNIV. (NIGERIA). DEPT. OF BIOLOGICAL SCIENCES.
Effects of Sawdust Pollution on the Germination of Fungal Spores in Lagos Lagoon,
W87-08109 5C

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.
Plutonium, Cesium, Uranium, and Thorium Series Radionuclides in the Hudson River Estuary and Other Environments: Annual Technical Progress Report,
W87-08411 5B

LANDESAMT FUER WASSERWIRTSCHAFT RHEINLAND-PFALZ, MAINZ (GERMANY, F.R.).
Comparison of Head-Space and Extraction Technique in the Gas Chromatographic Determination of Halogenated Hydrocarbons Using a Statistical Model to Evaluate Systematical Errors (Vergleich der Head-Space-Technik mit der Extraktionsmethode in der Gaschromatographie bei der HKW-Bestimmung mit einem Statistischen Modell zur Erkennung systematischer Fehler),
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LANGSTON UNIV., OK.
Effectiveness of Blue Tilapia as a Weed Control Agent in Ponds,
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LAURENTIAN UNIV., SUDBURY (ONTARIO). DEPT. OF BIOLOGY.
Psychrophiles, Psychrotrophs, and Glucose Mineralization in a Lake with Seasonal Temperature Fluctuations,
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Copper, Cadmium, and Nickel Accumulation in Crayfish Populations Near Copper-Nickel Smelters at Sudbury, Ontario, Canada,
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LAVAL UNIV., QUEBEC. DEPT. DE GENIE CHIMIQUE.
Towards the Prediction of Sahelian Rainfall from Sea Surface Temperatures in the Gulf of Guinea,
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LEVER (WILLIAM F.) AND ASSOCIATES, LONG BEACH, CA.
Manual for Highway Storm Water Pumping Stations: Volume 1.
W87-08248 8C

LEYLAND CONSULTANTS LTD., AUCKLAND (NEW ZEALAND).
Equipment for Small Hydro Schemes: A Review of Progress,
W87-07628 8C

LIEGE UNIV. (BELGIUM). INST. DE PATHOLOGIE.
Toxicogenetic Effects Linked to the Chlorination of Drinking Water (Effets Toxicogenetiques Lies a la Chloration des Eaux Alimentaires),
W87-07788 5B

LILLE-2 UNIV. (FRANCE).
Pathology Linked to Water Use (Pathologie Liee a l'susage de l'eau),
W87-07787 5C

LIMNOLOGICAL ASSOCIATES, KANEOHE, HI.
Supersaturation of Nitrogen Gas Caused by Artifical Aeration in Reservoirs,
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LIMNOLOGISCH INST., OOSTERZEE (NETHERLANDS). TJEUKEMEER LAB.
Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
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LITTLE (ARTHUR D.), INC., CAMBRIDGE, MA.
Monitoring of Solid Waste Disposal Sites: What Factors are Relevant for Electric Utilities,
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LIVERPOOL UNIV. (ENGLAND). DEPT. OF ZOOLOGY.
Occurrence of Metacercariae of the Trematode, Cyathocotyle opaca (Wisniewski), in Three Species of Lake-Dwelling Leeches,
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LOCKHEED-EMSCO, LAS VEGAS, NV.
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LOS ALAMOS NATIONAL LAB., NM.
Testing of Lateral Water Flow in a Moisture Barrier,
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Health Aspects of Groundwater Recharge,
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LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF CIVIL ENGINEERING.
1-D, 2-D, and 3-D Infiltration for Irrigation,
W87-08589 3F

LOUISIANA STATE UNIV., BATON ROUGE. HAZARDOUS WASTE RESEARCH CENTER.
Bedform-Generated Convective Transport in Bottom Sediment,
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LUND UNIV. (SWEDEN). DEPT. OF WATER RESOURCES ENGINEERING.
Spatial Variability of Infiltration in a Semi-Arid Environment,
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LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.
Zooplankton and Fish Accumulate Chlorinated Hydrocarbons from Contaminated Sediments,
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LYON-1 UNIV., VILLEURBANNE (FRANCE).
Graphical Approach to Principal Component Analysis: Utilization in Hydrobiology (Approche Graphique de l'Analyse en Composantes Principales Normee: Utilisation en Hydrobiologie),
W87-08286 7C

LYON-1 UNIV., VILLEURBANNE (FRANCE). DEPT. DE BIOLOGIE ANIMALE ET ECOLOGIE.
Description of a Lotic Environment (the French Upper Rhone) Using Discriminant Analysis on Qualitative Variables (Approche par l'Analyse Discriminante sur Variables Qualitatives d'un Milieu Lotique, le Haut Rhone Francais),
W87-08283 6G

LYON-1 UNIV., VILLEURBANNE (FRANCE). LAB. D'ECOPHYSIOLOGIE.
Predatory Behavior of the Alpine Triton (Triturus Alpestris) in an Alpine Lake (2 125m, French Alps) (Activite Predatrice du Triton Alpestre (Triturus Alpestris) dans un Lac Alpin (2,125 m, Alpes Francaises)),
W87-08282 2H

LYONNAISE DES EAUX, CANNES (FRANCE).
Town of Vallauris (French Riviera - An Example of a Coastal Area Sanitation Improvement Project,
W87-08542 5D

MAINE UNIV. AT ORONO. DEPT. OF CIVIL ENGINEERING.
Point-of-Entry Removal of Radon From Drinking Water,
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MAINE UNIV. AT ORONO. LAND AND WATER RESOURCES CENTER.
Biogeochemical Responses of Forest Canopies to Acid Precipitation,
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MALAGA UNIV. (SPAIN). DEPT. OF MICROBIOLOGY.
Comparative Study of Different Methods for Detection and Enumeration of Salmonella spp. in Natural Waters,
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MANITOBA DEPT. OF NATURAL RESOURCES, WINNIPEG. WATER RESOURCES BRANCH.
Dakota Aquifer System in the Province of Manitoba,
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MANITOBA UNIV., WINNIPEG. DEPT. OF CHEMISTRY.
Preconcentration of Trace Metals from Aquatic Environmental Samples,
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MANITOBA UNIV., WINNIPEG. DEPT. OF SOIL SCIENCE.
Effect of Soil Water and Temperature on Corn (Zea mays L.) Root Growth during Emergence,
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Transient Groundwater Flow Surrounding a Recharge Slough in a Till Plain,
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MANITOBA UNIV., WINNIPEG. PESTICIDE RESEARCH LAB.
Environmentally Significant Photochemistry of Chlorinated Benzenes and their Derivatives in Aquatic Systems,
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MANSOURA UNIV. (EGYPT). FACULTY OF PHARMACY.
Spectrophotometric Determination of Inorganic Phosphate in Egypt Water Using Resazurine and Para-Rosolic Acid,
W87-08578 5A

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM, PLYMOUTH (ENGLAND).
Bioavailability and Effects of Heavy Metals in Marine Deposits,
W87-07731 5C

MARINE BIOLOGICAL LAB., WOODS HOLE, MA.
Measurement of Bacterial Chlorophyll and Algal Chlorophyll a in Natural Waters,
W87-07955 7B

MARYLAND DEPT. OF PUBLIC WORKS, ELLICOTT CITY.
Water Conservation in Rental Apartment Complexes by Means of Controlled Installation of Watersaving Devices,
W87-08437 3D

MARYLAND UNIV., CAMBRIDGE. HORN POINT ENVIRONMENTAL LABS.
Production, Predation, and Decomposition in a Low-Salinity Hibiscus Marsh,
W87-07976 2L

Lateral Variation in the Production and Fate of Phytoplankton in a Partially Stratified Estuary,
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MARYLAND UNIV., COLLEGE PARK. DEPT. OF CIVIL ENGINEERING.
Desorption of 2,3,7,8-TCDD from Soils into Water/Methanol and Methanol Liquid Phases,
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MARYLAND UNIV., COLLEGE PARK. DEPT. OF MATHEMATICS.
Lognormality of Rain Rate,
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MARYLAND UNIV., COLLEGE PARK. DEPT. OF METEOROLOGY.
Thunderstorms: An Important Mechanism in the Transport of Air Pollutants,
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MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.
Effects of Microcosm Salinity and Organic Substrate Concentration on Production of Vibrio cholerae Enterotoxin,
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MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.
Kinetics of Nutrient Uptake and Growth in Phytoplankton,
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Application of Nonlinear Filtering in the Real Time Forecasting of River Flows,
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Comparison of Three Groundwater Modeling Studies,
W87-08597 2F

MASSACHUSETTS UNIV. AT BOSTON. ENVIRONMENTAL SCIENCE PROGRAM.
Hydrocarbons in Southern California Municipal Wastes and their Input to Coastal Waters,
W87-07736 5A

MAX-PLANCK-INST. FUER LIMNOLOGIE ZU PLOEN (GERMANY, F.R.).
Morphometry and Chlorophyll Production in Eastholstein Lakes (Morphometrie und Chlorophyllproduktion von Ostholsteinischen Seen),
W87-08527 2H

MAX-PLANCK-INST. FUER LIMNOLOGIE ZU PLOEN (GERMANY, F.R.). ABT. MIKROBENOEKOLOGIE.
Bacterial Growth in Mixed Cultures on Dissolved Organic Carbon from Humic and Clear Waters,
W87-08045 2H

MAX-PLANCK-INST. FUER MEDIZINISCHE FORSCHUNG, HEIDELBERG (GERMANY, F.R.). ABT. PHYSIOLOGIE.
Trialkyllead Occurrence, Biological Interactions, and Possible Impact on Forest Decline,
W87-07820 5C

MCGILL UNIV., MONTREAL (QUEBEC). DEPT. OF BIOLOGY.
Effect of Ambient Oxygen Concentration on Measurements of Sediment Oxygen Consumption,
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Simple Method of Measuring Seston Respiration in Oligotrophic Lakes,
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MCKEESPORT MUNICIPAL AUTHORITY WASTEWATER TREATMENT PLANT, PA.
Case History of a Flooding Disaster at a Wastewater Treatment Plant: McKeesport, PA,
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MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF BIOLOGY.
Comparative Epidemiology: The Use of Fishes in Assessing Carcinogenic Contaminants,
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Influence of Water Hardness, pH, and Alkalinity on the Mechanisms of Copper Toxicity in Juvenile Rainbow Trout, Salmo gairdneri,
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MCNEESE STATE UNIV., LAKE CHARLES, LA. DEPT. OF CHEMISTRY.
Periphyton as Monitors for Heavy Metal Pollution in the Calcasieu River Estuary,
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MEDICAL COLL. OF WISCONSIN, INC., MILWAUKEE. DEPT. OF PHARMACOLOGY AND TOXICOLOGY.
Behavioral and Histological Effects of Acrylamide in Rainbow Trout,
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MELBOURNE UNIV., PARKVILLE (AUSTRALIA). DEPT. OF BOTANY.
Osmotic Adjustment, Induced by Drought, in Seedlings of Three Eucalyptus Species,
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MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. DEPT. OF BIOLOGY.
Influence of Water Temperature on Behavioural Interactions between Juvenile Brook Charr, Salvelinus fontinalis, and Rainbow Trout, Salmo gairdneri,
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MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. DEPT. OF PHYSICS.
Turbidity Currents and Submarine Channel Formation in Rupert Inlet, British Columbia: 1. Surge Observations,
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Turbidity Currents and Submarine Channel Formation in Rupert Inlet, British Columbia: 2. The Roles of Continuous and Surge-Type Flow,
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MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. FACULTY OF ENGINEERING AND APPLIED SCIENCE.
Estimation of Dilution in Buoyant Effluents Discharged into a Current,
W87-08077 5E

MESA CORP., OREM, UT.
Cultural Resources Class I Survey of the Central Utah Area: Volume 3, Utah Water Development History Research Unit,
W87-08252 6G

MESSINA UNIV. (ITALY). IST. DI BOTANICA.
Xylem Cavitation in Nodes and Internodes of Whole Chorisia insignis H.B. et K. Plants Subjected to Water Stress: Relations between Xylem Conduit Size and Cavitation,
W87-07999 2I

METEOROLOGICAL RESEARCH INST., YATABE (JAPAN).
Structure of a Typhoon Rainband Observed by Two Doppler Radars,
W87-08129 2B

METEOROLOGIE NATIONALE, PARIS (FRANCE).
Functional Box-Counting and Multiple Elliptical Dimensions in Rain,
W87-08539 2B

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, IL.
Municipal Sludge Management,
W87-08168 5E

METROPOLITAN WATERSAVING CO., WASHINGTON, DC.
Water-Saving Plumbing: A Flow Control and Maintenance Program to Reduce and Control Water Use in Multi-Housing Properties,
W87-08424 3D

MIAMI UNIV., CORAL GABLES, FL. DEPT. OF CIVIL AND ARCHITECTURAL ENGINEERING.
Principles of Water Quality,
W87-08391 5B

Water Quality Modeling,
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, STONY BROOK, NY. OFFICE OF SEA GRANT.
Sewage-Sludge Dumping in the New York Bight Apex: A Comparison with Other Proposed Ocean Dumpsites,
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, DC. CLIMATE ANALYSIS CENTER.
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Geohydrology of the Dakota Aquifer.
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Before the Well Runs Dry: A Handbook for Designing a Local Water Conservation Plan.
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Pollution Across Borders: Acid Rain - Acid Diplomacy.
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Effect of Ambient Ozone Pollution and Acidic Rain on the Growth and Chlorophyll Content of Green and White Ash,
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Some Analytical Considerations Relating to the Development of a High-Resolution Mass Spectrometric Dioxin Analytical Protocol,
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Archaeological Investigations in the Southern Section of the Garrison Diversion Unit in North Dakota, 1984,
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Solution of Contaminant Transport Equations Using an Orthogonal-Upstream Finite Element Scheme,
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Geochemistry of the Dalhousie Ocean Dumpsite,
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Sulfate Reduction in a Coastal Lake during Summer Stratification,
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Acid Rain and Transported Air Pollutants: Implications for Public Policy.
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Archaeological Resources Records Review for the United States Department of the Interior, Bureau of Reclamation Projects; Fort Cobb, Norman, Foss, Altus, Mountain Park, and Arbuckle, Oklahoma,
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Ontario Perspective on Acid Rain,
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Effect of Point and Diffuse Source Loadings on Mercury Concentrations in the Wabigoon River: Evidence of a Seasonally Varying Sediment-Water Partition,
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Partition Coefficient and Water Solubility in Environmental Chemistry,
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PABON, SIMS, SMITH AND ASSOCIATES, WASHINGTON, DC.
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PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, PORTLAND, OR.
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PENNSYLVANIA UNIV., PHILADELPHIA. DEPT. OF GEOLOGY.
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'This Everlasting Sand Bed': Cultural Resources Investigations at the Texas Big Sandy Project, Wood and Upshur Counties, Texas,
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Speciation of Manganese in Fresh Water - I: Use of EPR Studies,
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Heavy Metal Trace Determination with a Compact Thermal Ionization Quadrupole Mass Spectrometer. Part I. Analysis of Sewage Sludges, Soils and Analogous Materials (Schwermetall-Spurenbestimmung mit einem kompakten Thermionen-Quadrupol-Massenspektrometer Teil 1. Analyse von Klarschlammen, Boden und verwandten Materialien),
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Development of Multimedia Environmental Goals for Pollutants in Solid Wastes and Leachates,
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Scarce Water and Institutional Change.
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Simultaneous Photoreduction and Microbial Oxidation of Iron in a Stream in the New Jersey Pinelands,
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SAINT-JEROME UNIV., MARSEILLE (FRANCE). LAB. DE ZOOLOGIE ET BIOLOGIE MARINES.
Dissemination Strategies of Trematode Cercariae in a Marine Littoral Ecosystem (Strategies de Dissemination des Cercaires de Trematodes dans un Ecosysteme Marin Littoral),
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Analysis of Pumping Tests of the Culebra Dolomite Conducted at the H-3 Hydropad at the Waste Isolation Pilot Plant (WIPP) Site,
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Groundwater Discharge from Glacial and Bedrock Aquifers as a Soil Salinization Factor in Saskatchewan,
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Comparison of a New Rapid Extraction GC/MS/MS and the Contract Laboratory Program GC/MS Methodologies for the Analysis of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin,
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Assessing the Tolerance of Fish and Fish Populations to Environmental Stress: The Problems and Methods of Monitoring,
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Processing a Rather Difficult Kind of Water: The Lake of Bret (Traitement d'une Eau Difficile: le Lac de Bret),
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SEVERN-TRENT WATER AUTHORITY (ENGLAND).
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
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SHEFFIELD UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
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SHIGA PREFECTURAL INST. OF PUBLIC HEALTH AND ENVIRONMENTAL SCIENCE, OTSU (JAPAN).
Bioconcentration of Butyltin Compounds by Round Crucian Carp,
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Preconcentration Method for Phosphate in Water Using Activated Carbon Loaded with Zirconium,
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Evaluating the Wetland Resource,
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SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.
Plankton Response Following a Spring Upwelling Event in the Ria de Arosa, Spain,
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SOCIETE GRENOBLOISE D'ETUDES ET D'APPLICATIONS HYDRAULIQUES (FRANCE).
Prefabricated Powerplant Reduces Civil Works,
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SOCIETE POUR LA MESURE ET LE TRAITEMENT DES MILIEUX FLUIDES, LYON (FRANCE).
Experimental and Theoretical Analysis of Flow in a Mixed Flow Impeller (Mesures et Analyses de l'Ecoulement dans une Roue de Pompe Mixte),
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Land: Resource Base and Inventory,
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Soil and Water Resources: Research Priorities for the Nation.
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SOUTH CAROLINA UNIV., COLUMBIA. DEPT. OF BIOLOGY.
Sediment Stability around Animal Tubes: The Roles of Hydrodynamic Processes and Biotic Activity,
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SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY, RAPID CITY. INST. OF ATMOSPHERIC SCIENCES.
Analysis of Spatial Inhomogeneities in Cumulus Clouds Using High Spatial Resolution Landsat Data,
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Overview of South Dakota's Dakota Aquifer,
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SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF AGRICULTURAL ENGINEERING.
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Information and Consumer Adoption of Water Conservation Measures,
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Preliminary Observations on Use of Ethanol Distiller's By-products for Polyculture of Freshwater Prawn (Macrobrachium rosenbergii) and Golden Shiner (Notemigonus crysoleucas),
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Drastically Disturbed Lands: Conservation Needs, Technology, and Policy Alternatives,
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Hydrogeology and Development of the Dakota Aquifer in Southwest Kansas,
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Technical Guide to Water Management on Small Farms,
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Planning the Disposal of Waste Waters for Small Tourist Resorts in Dalmatia,
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SRI VENKATESWARA UNIV., TIRUPATI (INDIA). DEPT. OF ZOOLOGY.
Metabolic Consequences of Methyl Parathion Exposure in the Bivalve, Lamellidens marginalis (Lamarck),
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STATE UNIV. OF NEW YORK AT BINGHAMTON. DEPT. OF BIOLOGICAL SCIENCES.
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Hypersaline Gradients in Two Canadian High Arctic Lakes,
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Energetics of Dredged-Material Dispersal,
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State of Ecosystem Medicine,
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Performance Requirements and Test Procedures for Water Closets,
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New Selective Medium for Isolating Pseudomonas spp. from Water,
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Greenland Case Study: Water Supply,
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Role of Exocellular Polymer in the Design of Activated Sludge,
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Determination of the Speed of Moving Rainfall Patterns,
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TECHNISCHE UNIV. BERLIN (GERMANY, F.R.). DEPT. OF HYGIENE.
Survival of Selected Bacterial Species in Sterilized Activated Carbon Filters and Biological Activated Carbon Filters,
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TECHNISCHE UNIV., BRUNSWICK (GERMANY, F.R.). INST. FUER STANDBAUWESEN.
Reuse of Wastewaters in Agriculture by Means of Sprinkler Irrigation on a Farmland Area of 3000 ha - Large Scale Experience in Germany,
W87-08555 3C

TECHNISCHE UNIV. HAMBURG-HARBURG (GERMANY, F.R.).
Role of Riverbank Filtration Along the Rhine River for Municipal and Industrial Water Supply,
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Assessment of Metal Pollution In Rivers and Estuaries,
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TECHNISCHE UNIV., MUNICH (GERMANY, F.R.). INST. FUER WASSERCHEMIE UND CHEMISCHE BALNEOLOGIE.
Stability Spectra for the Description of Copper-Humic Complexes: A Fluorescence Quench Study,
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Lognormal Fit to Raindrop Spectra from Frontal Convective Clouds in Israel,
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How to Handle a Bout with Drought,
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Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants; Part 2,
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Paraje (de Fra Cristobal): Investigations of a Territorial Period Hispanic Village Site in Southern New Mexico,
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TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF SOIL AND CROP SCIENCES.
Land Treatment of Hazardous Wastes,
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Finite Element Modeling of Couples Heat and Moisture Transport in Permafrost,
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Resource Impact Evaluation of In-Situ Uranium Groundwater Restoration,
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Arsenic Toxicity Changes in the Presence of Sediment,
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Survival of Pathogenic Bacteria in Various Freshwater Sediments,
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Reproductive Toxicology of Aquatic Contaminants,
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TITOGRAD UNIV. (YUGOSLAVIA). INST. OF CHEMISTRY.
Investigation of the Treatment and Recycling of Oil Refinery Wastewater,
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Combined Microbiological and Advanced Treatment of Oil Refinery and Municipal Wastewaters,
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TOHOKU UNIV., SENDAI (JAPAN). LAB. OF PLANT BREEDING.
Leaf Properties Related to the Photosynthetic Response to Drought in Upland and Lowland Rice Varieties,
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TOKYO INST. OF TECH. (JAPAN). DEPT. OF ENVIRONMENTAL CHEMISTRY AND ENGINEERING.
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TOKYO METROPOLITAN UNIV. (JAPAN). DEPT. OF CHEMISTRY.
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TORONTO UNIV. (ONTARIO). DEPT. OF CHEMICAL ENGINEERING AND APPLIED CHEMISTRY.
Environmental and Laboratory Rates of Volatilization of Toxic Chemicals from Water,
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TORONTO UNIV. (ONTARIO). DEPT. OF ZOOLOGY.
Distribution of the Stonefly Nymph Paragnetina media (Plecoptera:Perlidae): Influence of Prey, Predators, Current Speed, and Substrate Composition,
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TORONTO UNIV. (ONTARIO). GROUNDWATER RESEARCH GROUP.
Field Study of Scale-Dependent Dispersion in a Sandy Aquifer,
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TORONTO UNIV. (ONTARIO). INST. FOR ENVIRONMENTAL STUDIES.
Mercury Levels in Ontario Mink and Otter Relative to Food Levels and Environmental Acidification,
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TORONTO UNIV. (ONTARIO). INST. OF AEROPHYSICS.
Plankton Size Spectra in Relation to Ecosystem Productivity, Size, and Perturbation,
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TRANSKEI UNIV., UMTATA (SOUTH AFRICA). DEPT. OF ZOOLOGY.
Microbenthos, Meiobenthos and Fiddler Crabs: Trophic Interactions in a Tropical Mangrove Sediment,
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TRENT UNIV., PETERBOROUGH (ONTARIO). DEPT. OF GEOGRAPHY.
Modelling the Areal Depletion of Snowcover in a Forested Catchment,
W87-08120 2C

TRENT UNIV., PETERBOROUGH (ONTARIO). WATERSHED ECOSYSTEMS PROGRAM.
Zinc and Cadmium Transport by the Vertically Migrating Opossum Shrimp, Mysis relicta,
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TRIESTE UNIV. (ITALY). IST. DI IDRAULICA.
Impact of 'Organic 'Pollutants on Coastal Waters, Gulf of Trieste,
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TRW, INC., MCLEAN, VA. ENERGY AND ENVIRONMENTAL DIV.
Hydrologic Characterization of NOSR 1.
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TURKU UNIV. (FINLAND). DEPT. OF BIOLOGY.
Elemental Composition of Juncus bulbosus in an Acidified Freshwater Reservoir,
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UKAEA ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL (ENGLAND). WASTE RESEARCH UNIT.
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UKRAINSKII NAUCHNO-ISSLEDOVATEL'SKII INST. TSELLIULOZNOII BUMAZHNO PROMYSHLENNOSTI, KIEV (USSR).
Gas Chromatographic Determination of Organic Components in Effluents from Mills for Processing Waste Paper,
W87-07960 5A

UNIVERSIDAD TECNICA FEDERICO SANTA MARIA, VALPARAISO (CHILE). DEPT. OF CHEMISTRY.
Organochlorine Pesticide Residues in Chilean Fish and Shellfish Species,
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